FLIGHT, FEBRUARY 28, 1935

FIRST AERO WEEKLY IN THE WORLD

REGD AT THE G.P.O AS A NEWSPAPER

# FLIGHT

The AIRCRAFT ENGINEER AND AIRSHIPS

No. 1366
Vol. XXVII

OFFICIAL ORGAN OF THE ROYAL AERO CLUB

SIXPENCE
EVERY THURSDAY

# FLIGHT

The AIRCRAFT ENGINEER AND AIRSHIPS

Founded in 1909

FIRST AERONAUTICAL WEEKLY IN THE WORLD

OFFICIAL ORGAN OF THE ROYAL AERO CLUB

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## Germany and the Air Pact

GERMANY has accepted the Anglo-French proposals for an air pact as a basis for negotiations, and this bodes well for the prospects of peace. Matters have now reached a stage where the actual air side of the proposals looms less large than do general politics and methods of procedure. The Anglo-French proposals only provide for the peace of western Europe, but eastern Europe also has its problems. Nazi Germany and Soviet Russia are suspicious of each other. The system of the former is the extreme of what is called "Right" politics and that of the other is the extreme of the "Left," although the extremes meet in the suppression by both of popular liberty. France has entered into some sort of understanding with the Soviet. The latter is inclined to view the Anglo-French proposals as a plan which would secure Germany's western frontier and leave her free to turn her full attention to her eastern frontier if misunderstandings in that quarter ever became acute. France sympathises to some extent with this Russian point of view, and therefore has pressed for the conclusion of an eastern European pact between Germany, Poland and Russia at the same time as the conclusion of the western pact. That is the first complication.

Next, from a German source comes the reflection that such an eastern pact would safeguard Russia's western frontier, and would leave her free to pay full attention to her Asiatic pre-occupations. One cannot imagine that such a development would be very welcome to Japan, and it is not inconceivable that Britain might sympathise with Japan's feelings, though as yet they have not been expressed. Further complications are added by the need for pacts to settle the questions of the Danube States and the Balkan States if the peace of Europe is to be placed on a firm foundation.

At first Germany showed a disposition to discuss only the proposed western air pact, leaving the question of eastern Europe unsettled, and this attitude was not agreeable to France. The latest news, however, is that Hitler is willing to discuss all outstanding questions, and for this reason it is announced that Sir John Simon will shortly visit Germany. It has also been suggested that he should afterwards go on to Warsaw and Moscow, perhaps also to Prague. Britain is not directly interested in the eastern questions, and for that reason her influence would be welcomed as a disinterested party.

## Flying Boat Research

ALTHOUGH it has been in use for approximately two years, comparatively little has hitherto been known of the large tank at the Royal Aircraft Establishment at Farnborough. The paper by Mr. Coombes, a summary of which is published elsewhere in this issue, has done much to indicate the care and trouble taken to ensure that the tank results shall be reliable and form a good guide to the behaviour of the full-size machine, although there may, perhaps, be those who will regard two years as rather a long "period of probation." It should be realised, however, that once the fundamental characteristics of the tank and its equipment have been ascertained, the road is open for research into the problems which still face the designer of flying boats and floatplanes.

An examination of the tabulated figures of tank dimensions indicates that the committee which was appointed to select the size of tank at Farnborough has been very modest in its demands. The R.A.E. tank is much smaller than those possessed by the United States of America and Germany—so much smaller, in fact, that the size of model which can be tested is in the ratio of 1 : 2 : 3. Mr. Coombes did not make it clear whether the relatively small size was selected because it was considered that the larger size would not give improvement in results commensurate with the extra cost, or whether it was chosen because funds for a larger size could not be obtained. We trust the former was the deciding factor. In no sphere of research can we less afford to be parsimonious than in seaplane research.

Mr. Coombes made it quite clear that a great deal of

thought was given to the tank equipment, and an instance is the introduction in the R.A.E. tank of the pendulum device which makes it possible to make tests in accelerated motion. The Americans had developed a system whereby a series of seventy runs with a model had to be repeated at four different angles, necessitating, in all, 280 runs. In the R.A.E. tank the same ground was covered for one particular model by a series of accelerated runs, the same amount of information being collected in about thirty runs.

## New Research Types

NO less welcome than the inauguration of actual work in the tank at the R.A.E. is the announcement that the Air Ministry has placed orders for two new research types of aircraft: a long-range aeroplane and an aircraft for stratosphere exploration. Few of the records recognised by the F.A.I. are of as great practical utility as the long-distance record. Merely to remain in the air for a very long period is not proof of any particular merit on the part of the machine, as it may be, and probably is, too slow to be of any practical value for air transport. But, to cover a very great distance without refuelling, an aeroplane must of necessity be reasonably fast, which means high aerodynamic efficiency, and must also have high structural efficiency to carry the large fuel load, while the engine must use as little fuel as possible and must, therefore, be efficient also.

Perhaps of less immediate utility is flying at very great heights. For the present it will not be possible to carry passengers at altitudes of 50,000 ft. or so; but the day may well come when this will be done on trans-oceanic routes. There are advantages in speed to be obtained from flying in the rarefied air. While the lift decreases in proportion to the density of the air, so does the drag, and therefore if the engine power can be maintained, and can be efficiently transformed into thrust by a controllable pitch airscrew and/or two- or three-speed gear, the possibilities of high average speed on a long route, where the time taken to reach the operational height is not a large percentage of the total flying time, are considerable. There are, however, many problems to be solved first. To begin with, special superchargers have to be developed, and will most likely have to be of the two-stage or even three-stage type. Then there is the problem of supplying the occupants with oxygen. It will not suffice to equip them with the usual apparatus, as the low pressure of the surrounding air could not be coped with by the human body. An airtight cabin will be required, in which the air is somehow maintained at something like ground level pressures. Some form of pump mechanism will have to look after this, and must be of such capacity that, even if the cabin should develop a small leak, the pumps could maintain the necessary pressure.

**THE SOUTH ATLANTIC "COMET": *Salazar*, once *Black Magic*, the "Comet" which has been bought by the Portuguese Government and which is to be flown across the South Atlantic by Bleck and Macedo. Mr. Buckingham, of De Havillands', was flying the machine near Hatfield when a *Flight* photographer took this picture—the first close-up view of a "Comet" taken from another aeroplane.**

# The Outlook

## A Running Commentary on Air Topics

### Safeguarding the Passenger

LAST week's Essex tragedy may lead to new and difficult regulations concerning the arrangement of cabin doors and the supervision of air passengers. It will be sad indeed for the small operator if it is ordained that a steward or wireless operator *must* remain in the passengers' cabin throughout all scheduled flights, but this affair was only one of several similar, but not as serious, incidents, and some action should be taken to prevent a recurrence.

One obvious solution, it seems, would be to arrange a locking device and an indicator operated by and watched by the pilot himself. Such a device would, at the same time, be a great comfort to him while taxi-ing away from the tarmac, for he would know for certain that all was well before opening up for the take-off. In the event of desperately bad weather, or of the possibility of a forced landing, the pilot could unlock the door while in the air in case he himself happened to be incapacitated later. If the idea of loading the pilot with yet another responsibility is resented, then the lock might be operated by some trip device from the undercarriage, so that when the machine leaves the ground and the load is removed, the door is automatically locked, and *vice versa*.

### Shortage of Pilots?

ONE of the more extraordinary paradoxes in the world of aviation is that the supply of really good transport pilots is limited, and that this supply is likely to be even more limited in a year or two. This is not to say that this country in particular suffers from a shortage of good *pilots*—far from it—but there is a distinction between the two. The good commercial pilot possesses both skill and experience in his own particular job, which is very different from any other.

The question is: How can a good pilot obtain the necessary experience under present arrangements? He may fly an accurate triangular course under a hood; he may pass all kinds of navigational examinations; he may have his radio "ticket"—but he still remains simply a pilot, and the unsubsidised operator, fighting hard to force a small profit out of the business, cannot often afford to run the type of commercial machine carrying a second pilot.

### A Suggested Solution

EVEN if he could, the problem would not be completely solved. The first pilot is not likely to hand over his responsibility in just those conditions likely to provide his co-pilot with some of the experience he requires. He will learn, for instance, when the more experienced pilot considers that discretion is the better part of valour. The new pilot's fault is that, in his keenness, he may try to get through when his terminal aerodrome is thickening, when a fuse has blown in his radio, and when his only navigational aid is a compass needle which continues to point to the North.

The only solution appears to be that operators should run special instructional services over all the routes—choosing the worst kind of weather. Obviously, the operators themselves cannot afford to run such services, however good they might be, so the cost would fall again on the unfortunate taxpayer. But in the increased reliability and safety of the airlines, which are, after all, only there for his benefit, he might obtain value for money.

### Was Langley (W)right?

ONE is prompted to this unseemly pun by the way in which the "Pou-du-Ciel," described in *Flight* of September 20, 1934, seems to be taking France by storm. This little machine, it may be remembered, is a tandem monoplane without horizontal tail and without ailerons. Monsieur Henri Mignet, the designer of the "Pou-du-Ciel," has placed his two wings so close together that he obtains what he claims to be a slot effect, which adds further to the non-spinning qualities of his machine. Lateral stability is obtained by using a large dihedral angle and suitably placing and proportioning the various vertical areas. If a wing drops the rudder is used to right the machine.

It would seem that the whole problem centres on the question of whether or not the rudder brings a wing up quickly enough. For example, if the "Pou-du-Ciel" is alighting on a day when there is a gusty wind blowing, and the machine is tilted to one side, does the use of the rudder right the machine quickly enough? If the answer is yes, it becomes a little difficult to see the justification for the retention of ailerons, at least on the "fool-proof" machine for the amateur. It would be passing strange if, after all these years, we should discover that Langley, who relied on the dihedral angle on his "aerodrome," was right, and that the Wright brothers, who first introduced wing-warping, linked to the rudder because of the evil effects of misuse, were wrong, and that we have been perpetuating the mistake for more than thirty years!

### "Until—"

"UNTIL the advent of the National League of Airmen the slowness of the aeroplanes on which the nation is relying to chase away possible enemies likely to go at nearly twice their speed has not been thought a matter of much moment."

Thus does the *Evening News*, of February 25, expound the wonderful results of some four weeks of effort. The scheme of the National League of Airmen was announced on January 30, and already we must presume that the speed of our fighters has become a matter of much moment. We would pause to ask "With whom is it a matter of moment?" Is it with the members and half-crown associates of the said League? If so, then, of course, the possible enemies with the speedy bombers must be shaking in their shoes. Or is it the Air Ministry whose concern has been so deeply awakened in the last four weeks? Of course, the opinions and actions of the Air Ministry do not matter very much, and presumably it was in a fit of drowsy absentmindedness that the Air Ministry began, rather more than four weeks ago, to equip No. 19 (Fighter) Squadron with Gloster "Gauntlets," which can fly at 230 miles an hour.

Accepting the statements of the *Evening News*, as every good citizen is in duty bound to do, these unfortunate "Gauntlets" will have to labour unavailingly after enemy bombers flying (and flying in formation, mark you!) at 460 miles an hour. Furthermore—and this really does seem to have been a most reprehensible and underhand queering of the National League of Airmen's pitch—the Air Ministry regards the "Gauntlet" as an "interim replacement," and is holding a competition for still faster fighters, for which there are eight entries. Why cannot the Air Ministry have the decency to wait until the National League of Airmen tells it what to do?

# A NEW SMALL ENGINE

## *The Cirrus "Minor," a 3,605 c.c. Four-in-line, Developing 70-80 b.h.p.*

THERE is undoubtedly a demand for small engines of about 70-80 h.p., particularly for the small two- or four-seater twin-engined machine, and it is only natural that firms specialising in four-in-line air-cooled engines should turn their attention to this market.

Readers will remember that last year the Cirrus-Hermes Engineering Company left Croydon and was to a considerable extent re-formed, under the chairmanship of Mr. Robert Blackburn; large, modern and spacious works were erected at Brough, adjoining those of the Blackburn Aeroplane and Motor Company.

Some little time before the move to Brough, Mr. C. S. Napier, younger son of the well-known aero engine designer of that name, joined the company as technical director, and one of the first things he did was to produce, in collaboration with Mr. A. H. Caple, a very clean and eminently practical inertia engine starter. Some time before that Mr. Napier himself had under construction a small aero engine of low power, and it is therefore not surprising to find that the first engine from the new factory is one of 70-80 h.p., called the Cirrus "Minor."

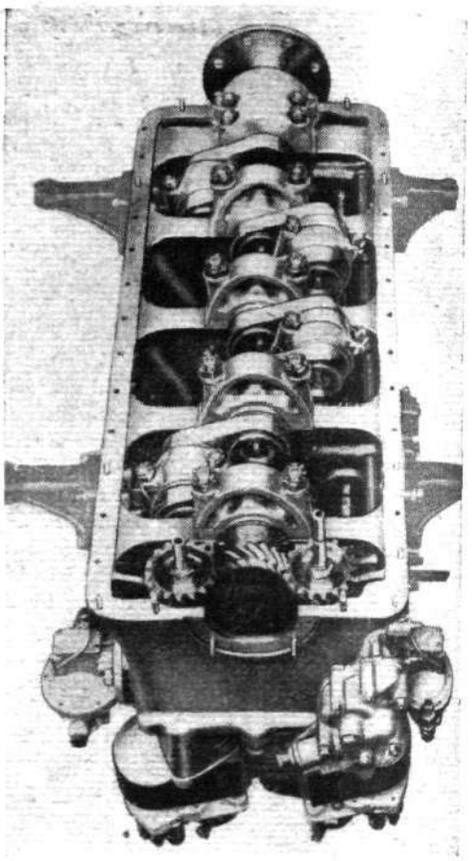
In its general layout it follows previous Cirrus engines, in that it is a four-cylinder inverted air-cooled engine. The cylinders are interesting, as they have been designed to obviate the use of long studs to the cylinder heads; our sketch explains the method whereby the heads are bolted to the barrels. The barrels, which are machined from forgings, are located in the crank case by spigots and secured by four short, stout bolts. The heads are Hiduminium alloy castings, and each one is clamped to the flange on its cylinder by eight studs, a gas-tight joint being maintained by laminated copper washers. The head itself forms one half of the valve-gear box, and has an Elektron cover forming an oil bath for the mechanism. The finning around the inlet and exhaust ports is so designed that there is an air space between them.

The valve mechanism itself is similar in most respects to that simple layout which has stood the test of time in the "Hermes Mark IV A" engines. The pistons, which each carry two compression rings and one scraper ring, are of the slipper type with fully floating gudgeon pins. The connecting rods are also of light alloy, being forged from Hiduminium and having white-metal bearings.

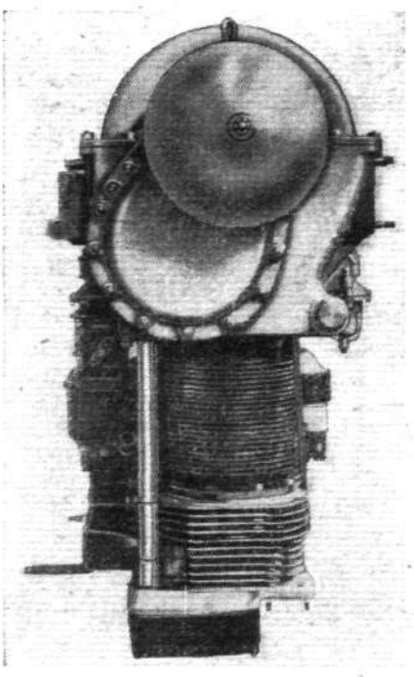
Particularly robust, the crankshaft is a steel forging and is carried in five plain bearings with a ball thrust bearing at the front end. The rear end carries a gear for

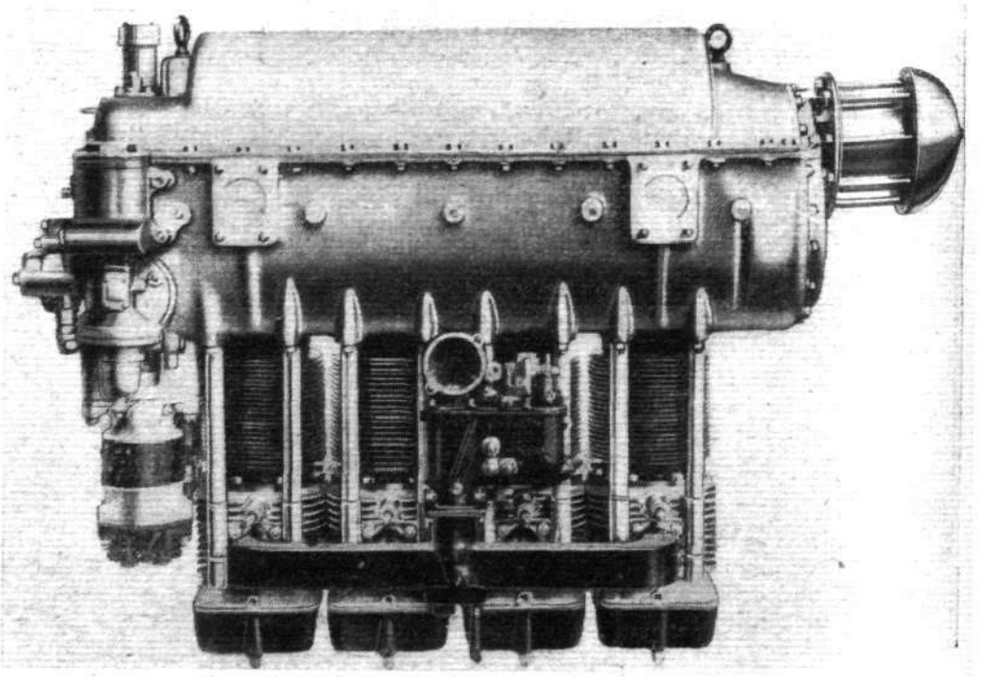
SPECIFICATION

Type: Air-cooled four-in-line; direct drive.
Rotation: Left-hand tractor.
Bore: 95 *mm.*
Stroke: 127 *mm.*
Capacity: 3,605 c.c.
Normal b.h.p.: 70 at 2,200 r.p.m.
Maximum b.h.p.: 80 at 2,400 r.p.m.
Cruising r.p.m.: 2,200
Compression ratio: 5.4 : 1.
Weight: 210 lb. approx.
Fuel consumption (normal r.p.m.): .54 pt./h.p./hr.
Fuel consumption (max. r.p.m.): .58 pt. per /h.p./hr.
Oil consumption: .5 pt./hr.
Oil pressure: 45-50 lb./sq. in. (25 lb./sq. in. minimum.)
Oil in circulation: 4 gall.
Overall length: 932 *mm.*
Height: 641 *mm.*
Width: 433 *mm.*
Bearer feet bolt centres (front to rear): 402 *mm.*
Bearer feet bolt centres (between front feet): 380 *mm.*
Bearer feet bolt centres (between rear feet): 429 *mm.*

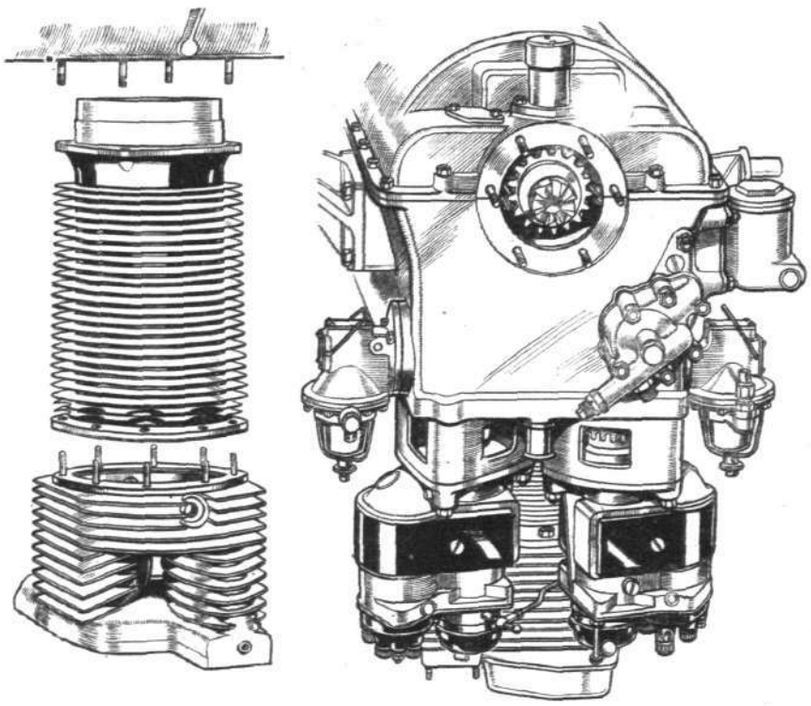


**The crank case of the Cirrus "Minor" with cover removed, showing the sturdy big-end bearings and the five main bearings; there is also, of course, a thrust bearing.**





**(Left) This view of the "Minor" indicates its small frontal area and shows the camshaft-drive casing.** (Right) The engine from the induction side.



Short studs hold the cylinder to the crank case, and another set secures the head. Note the air-space between the inlet and exhaust ports. The drawing on the right shows the rear end of the engine, with the two magnetos and their couplings, the oil pump, Amal fuel pumps, and dogs for the inertia starter connection.

operating the vertical magneto driving shaft, while a dog is fitted to the crankshaft to allow the use of an inertia starter.

The camshaft, also carried in five plain bearings, is driven from the front of the engine through simple spur gearing. The valves, which are operated by the camshaft through double, ball-ended push-rods and rocker levers, are of K.E.965 steel, and, with the exception of the rockers, all the valve gear is interchangeable. The one-piece valve tappets, passing through phosphor-bronze guides, are cup ended, and the valve clearances are easily set by means of an adjustable ball cup in the rockers, which, through a ball with a flat on it, operate on the valve stems.

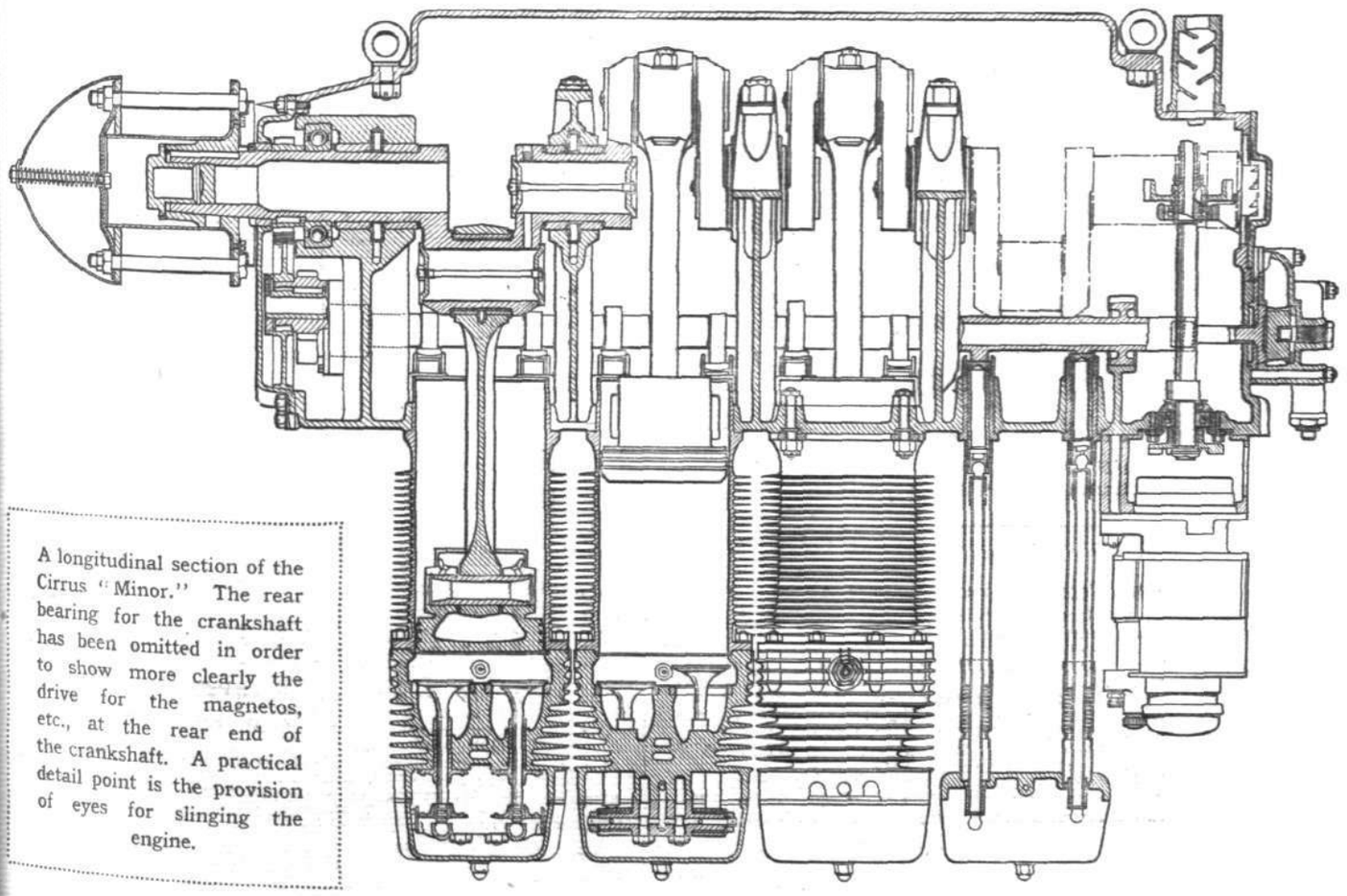
Carburation is by a Claudel-Hobson down-draught carburetter with an independent altitude control. Two B.T.H. S.G.4/2 magnetos, one with an impulse unit, form the ignition system, and supply current to K.L.G. 12 mm. sparking plugs. The crank case and its cover, as can be seen from the photographs, are very clean Elektron castings with all oilways inside, and, if required, Amal fuel pumps may be fitted, one on each side of the engine at the rear, where they are operated by cams on extensions of the vertical shafts which drive the magnetos.

Lubrication is provided by an oscillatory piston type of pump carried at the rear end of the crank case, and driven from the camshaft. It has a greater lift than the gear type of pump, and allows the oil tank to be placed well below the engine. It supplies oil to the engine through a filter, which is a separate unit attached to the rear end of the crank case. The four bearer feet are of the resilient type, and are supplied with the engine, as is a specially designed cooling chute with baffles.

In keeping with modern practice, the Cirrus "Minor" will be particularly well finished in stove enamel, with the bright parts cadmium plated.

It should be pointed out that the Cirrus "Minor" has not yet passed its type tests, and that it will not, therefore, be available for some time. The Cirrus "Major," a more powerful engine of generally similar design but greater dimensions, has already been running, and may possibly do its type tests before the "Minor." The series of test houses at Brough are so arranged that six engines can be tested simultaneously, so that there will be no avoidable delay in getting both models into production.

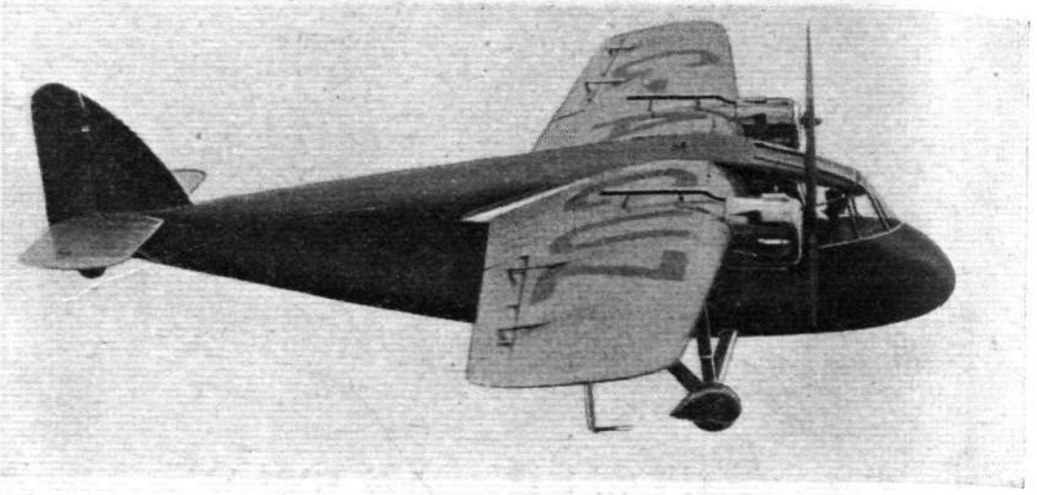
Prices have not, it is understood, been definitely decided upon at present, but they will be as low as is consistent with the high-grade materials and first-class workmanship put into the engines.



A longitudinal section of the Cirrus "Minor." The rear bearing for the crankshaft has been omitted in order to show more clearly the drive for the magnetos, etc., at the rear end of the crankshaft. A practical detail point is the provision of eyes for slinging the engine.

# THE IMPROVED SHORT "SCION"

## *Performance Figures for the New Model : A Comfortable Feeder-line or Ferry Machine*



**This flying picture shows how the Pobjoy "Niagara" engines have been cleanly faired into the wing and indicates the excellent outlook which the new nose design allows the pilot.** (*Flight* photograph)

WHEN the Short "Scion" first came out of the Rochester factory last year it created considerable interest because of its excellent performance and its unusually large cabin space. This, the latest improved model (a photograph of which appeared in *Flight* last week), should find even greater favour with those who require ample room for their passengers with economy of running cost. The cleaning-up process to which this new model has been subjected has resulted in a considerably increased performance, and makes the "Scion" an aeroplane which will not only be of great value for feeder lines and ferry air services, but also for the private owner who likes the security offered by two engines.

It will be seen that the two Pobjoy "Niagara" engines have been raised right up to the leading edge of the wings and have been very cleanly faired in. The shape of the nose of the machine has also been modified, not only so that the pilot has an improved outlook, but also to give a better entry for the fuselage and thus lower the total drag of the machine.

**The roomy cabin of the new "Scion"; its proximity to the ground makes entrance and egress very simple for passengers.**

Everyone who has flown the "Scion" agrees that the controls are admirably co-ordinated and that, taken as a whole, the machine is excellent to handle both in the air and on the ground.

**IMPROVED "SCION"**
**Two Pobjoy "Niagara" Engines**

DIMENSIONS

| | | *m* |
|---|---|---|
| Span, main plane | 42 ft. 0 in. | (*12,8*) |
| Length | 31 ,, 6 ,, | ( *9,6*) |
| Height (tail down) | 8 ,, 0 ,, | ( *2,4*) |
| Main plane area | 255.5 sq. ft. | (*23, 7 m²*) |

Cabin dimensions :—
10 ft. 0 in. long × 3 ft. 3 in. wide × 5 ft. 0 in. mean height. Capacity 163 cu. ft.
(*3 m × 0,98 m × 1,5 m—4,6 m³*)

WEIGHTS

| | | |
|---|---|---|
| Maximum permissible weight | 3,200 lb. | (*1 451,5 kg.*) |
| *Tare weight | 1,770 ,, | ( *808,8 ,,*) |
| Disposable load | 1,430 ,, | ( *648,6 ,,*) |
| Fuel, 31 galls. (*141 l*) | 239 ,, | ( *108,4 ,,*) |
| Oil, 3 galls. (*14 l*) | 29 ,, | ( *13,2 ,,*) |
| Pay load and pilot | 1,162 ,, | ( *527,1 ,,*) |
| †Lighting equipment | 55 ,, | ( *24,9 ,,*) |

PERFORMANCE

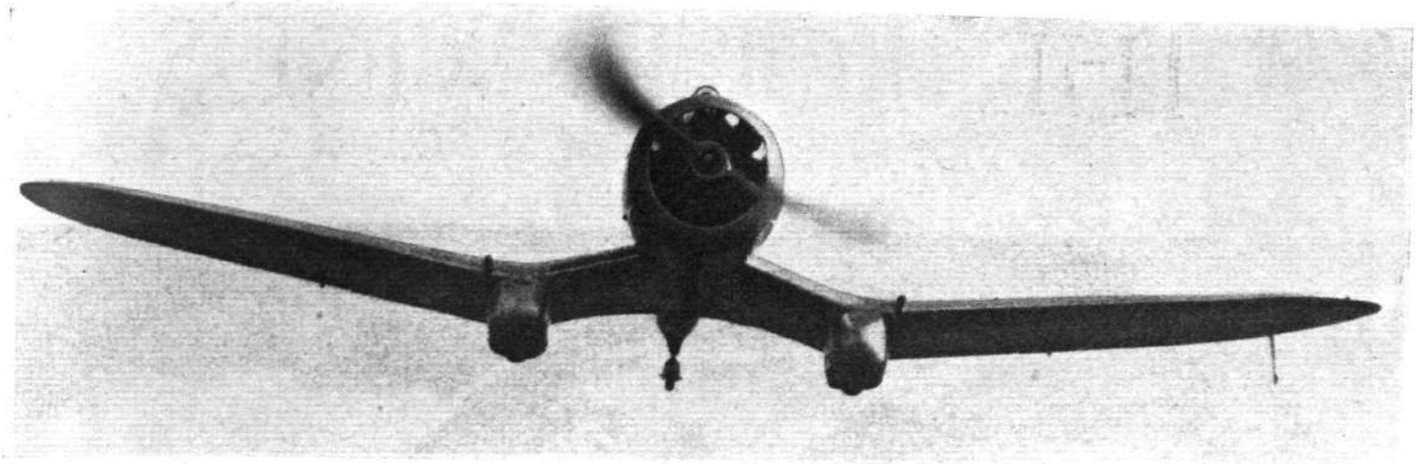
| | | |
|---|---|---|
| Maximum speed, 1,000 ft. (*304,8 m*) | 128 m.p.h. | (*205,0 km/h*) |
| Cruising speed, at 1,000 ft. (*304,8 m*), 3,100 r.p.m. | 112 ,, | (*180,2 ,,*) |
| Landing speed | 50 ,, | ( *80,5 ,,*) |
| Rate of climb (sea level) | 625 f.p.m. | (*3,17 m/sec*) |
| Absolute ceiling | 13,000 ft. | (*3 962,4 m*) |
| ‡Time to take-off | 15 sec. | |
| ‡Take-off run | 140 yd. | (*128 m*) |
| Landing run (with brakes) | 140 yd. | (*128 m*) |
| Fuel consumption (cruising 3,100 r.p.m.) | 9 gall/hr. | (*40,9 l/h*) |
| Range (cruising 3,100 r.p.m.) | 390 miles | (*627,6 km*) |

* In flying trim but less night flying equipment.
† *Full night flying equipment, including generator, battery, cabin and instrument lights, navigation lights, and landing headlight.*
‡ Against 5 m.p.h. (*134 m/sec*) wind.

## *Forthcoming Events*

Club Secretaries and others are invited to send particulars of important fixtures for inclusion in this list.

**Feb 27-28.** R.A.F. Individual Boxing Championships, Uxbridge.
**Mar. 1.** Annual Dance, Leicestershire Aero Club, Palais de Danse, Leicester.
**Mar. 1.** "Fuels for Aircraft Engines." R.Ae.S. Lecture by Mr. E. L. Bass.
**Mar. 5.** "Problems of Cold Presswork." Joint R.Ae.S. and Inst. A.E. Lecture by Dr H. Gough and Dr. Desch at Royal Geographical Society, London, S.W.7.
**Mar. 6.** Public Meeting at Stuart Hall, Norwich, on "Municipal Airport Development." (8 p.m.)
**Mar. 12.** "Recent Developments in the Lighting of Airways and Aerodromes." Joint R.Ae.S. and Illuminating Engineering Soc. Lecture, Inst. M.E., Storey's Gate, Westminster.
**Mar. 15.** "New Developments of the Autogiro." R.Ae.S. Lecture by Senor Juan de la Cierva.
**Mar. 15.** Annual Dinner and Dance. Cinque Ports Flying Club, Royal Pavilion Hotel, Folkestone.
**Mar. 23.** Rugby : R.A.F. v. Army, Twickenham.
**Mar. 29.** "Piloting Commercial Aircraft." R.Ae.S. Lecture by Sqn. Ldr. H. G. Brackley.
**Mar. 29.** Annual Dinner. Norfolk and Norwich Aero Club. Mousehold Aerodrome.
**Apr. 12.** "Commercial Aircraft." R.Ae.S. Lecture by Capt. G. de Havilland.
**May (Date not yet fixed).** Wilbur Wright Lecture, R.Ae.S., by Mr. Donald W. Douglas.
**May 29** Household Brigade Flying Club. Night - Flying Demonstration, Heston.
**June. 1.** Brooklands "At Home."
**Aug. 24-25.** Third International Flying Meeting, Lympne.
**Sept. 6-7.** King's Cup Air Race.



# THE BRISTOL MONOPLANE FIGHTER

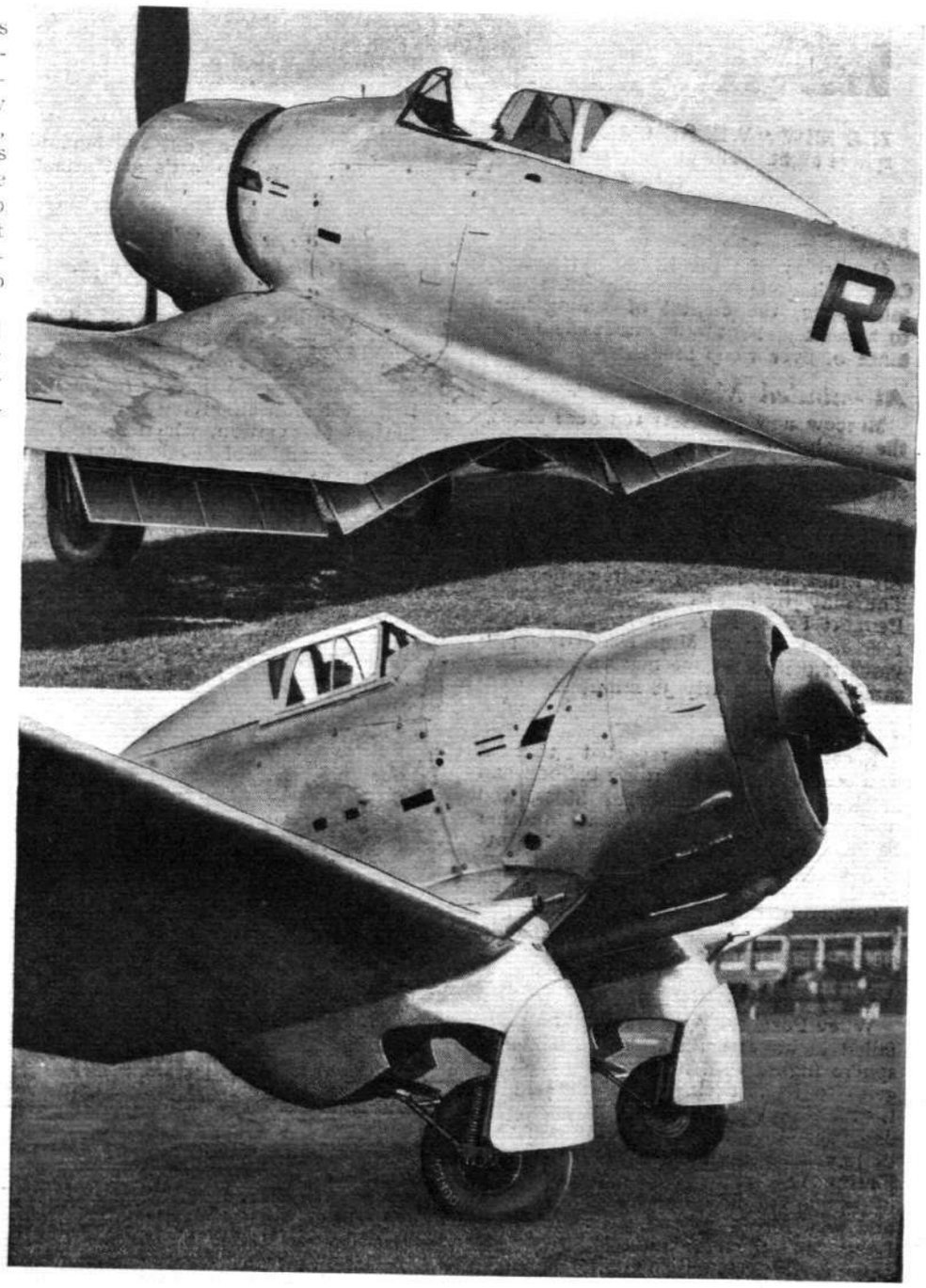
*Split Flaps and Retractable Undercarriage Contribute to Remarkable Performance*

MILITARY aircraft design is largely governed by the requirements which are paramount in air policy at any given time. If the policy changes, the design of military aircraft changes with it. Hitherto climb and extreme manœuvrability have been held to be the greatest necessity. Now that great speed has also become a necessity, several designers have turned to the monoplane type.

The latest to do so are the Bristol designers, and our photographs show the results. The Bristol single-seater fighter is a low-wing cantilever monoplane of all-metal construction, with stressed-skin covering. The low frontal area is well shown in the front view at the top of the page. Two objects are achieved by giving the wing roots a downward slope. The angle between the upper surface of the wing is less acute, and the distance from wing to ground is reduced, giving short undercarriage legs.

The wheels retract only partly into the wing, a curious "knee joint" being used, which is somehow reminiscent of the front legs of an elephant. When raised they do, however, form faired projections, so that the drag is probably very low. Some extra speed is also gained by providing a sliding transparent roof over the pilot's cockpit, and altogether the new Bristol is certainly one of the fastest British aeroplanes in existence. The engine is a Bristol "Pegasus."

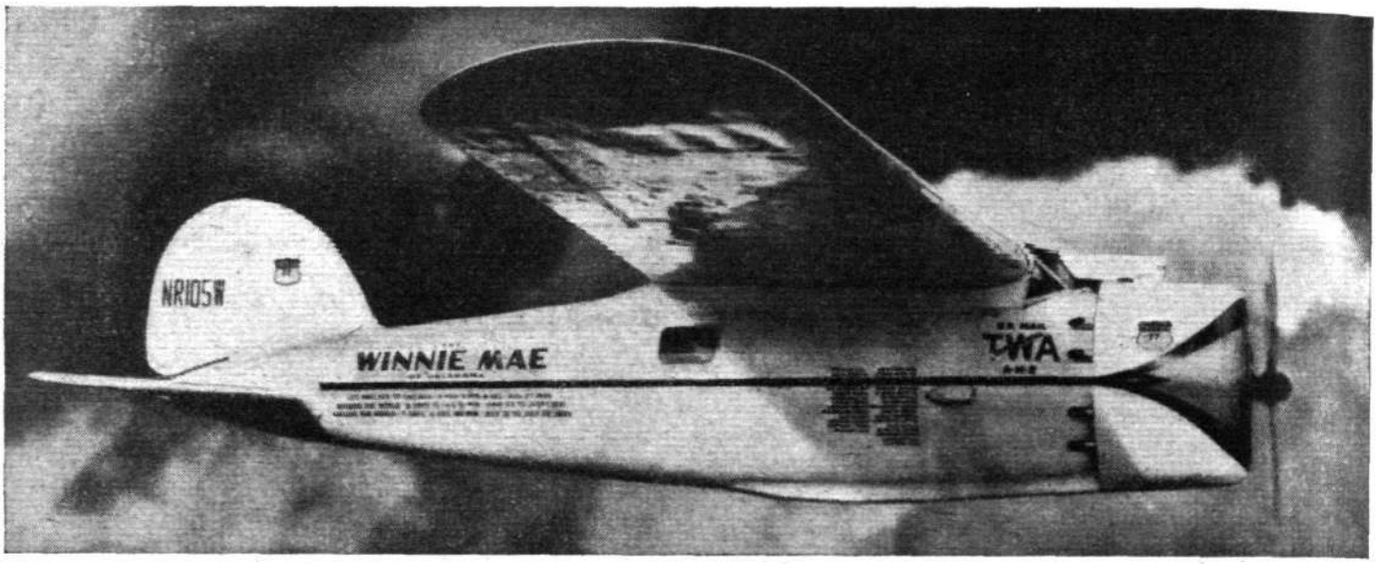
A reasonably low landing speed has been retained by using split trailing-edge flaps.



**Efficiency is the keynote of the new Bristol design. The low frontal area is indicated in the upper picture, while the lower ones show the split flaps and retractable undercarriage.** (*Flight* photographs.)

# THE FOUR WINDS

## ITEMS OF INTEREST FROM ALL QUARTERS




**THE NEW "WINNIE MAE": Wiley Post's Lockheed "Vega," *Winnie Mae*, as modified for his trans-continental stratosphere flight. The undercarriage is dropped immediately on taking off, and landing is accomplished on a skid on the bottom of the fuselage. As reported on this page, Post's first attempt at this flight failed.**

### *Madagascar-Rhodesia Non-stop*

On Friday last the Italian pilot, Cdr. Carlo Adamoil, flew non-stop from Antananarivo, the capital of Madagascar, to Salisbury, Southern Rhodesia, a distance of over 1,000 miles.

### *Air-minded Moscow*

Moscow now possesses ten aero clubs, the combined membership of which exceeds several thousands; the members study flying, gliding, and models.

### *New Trans-American Record*

Piloting a Vultee V1A of American Air Lines, Mr. Leland Andrews flew last Thursday from Los Angeles to Lloyd Bennett Field, N.Y., in 11 hr. 21 min. 1 sec., so beating Maj. Doolittle's previous trip in the same machine over the same route by nearly 38 minutes.

### *Higher Still*

Recently, *Flight* reported that a Russian automatic recording balloon had attained an altitude of 10½ miles, and now comes the news that another balloon, sent up by the Slutsk Institute of Aerology, has attained a height of nearly 15 miles, while a balloon sent up a few months ago from Moscow has just been located; its instruments registered an altitude of 19 miles.

### *Wiley Post Fails*

Wiley Post, the American-Indian pilot, failed in an attempt to make a stratosphere flight, with mails, from Los Angeles to New York. He started in his Lockheed "Vega," *Winnie Mae*, on Friday, shedding his undercarriage immediately after taking off, but after completing 125 miles, when at an altitude of 25,000 ft., he experienced oil trouble and was forced to descend near Muroc Lake, in the Mojave Desert. The *Winnie Mae* was only slightly damaged.

### *Twenty-five Years Ago*

*From "Flight" of February 26, 1910*

"Presiding at a meeting of the Bristol Tramways Company last week, Sir George White, Bart., said that for some time he and his brother had been giving their attention to aviation, which seemed to offer promise of development at no distant date, and they had determined to endeavour to develop the science both from the spectacular and the manufacturing point of view. They had already ordered three aeroplanes with a view to testing them, and when they have decided which is best they hoped to start a factory at Bristol."

**A FAMOUS TRIO: The Hon. "Freddie" Guest (centre) photographed with the Duchess of Bedford and Lord Trenchard on the occasion of his election as Master of the Guild of Air Pilots and Air Navigators.**

### *South African Achievement*

Capt. Stanley Halse and Mr. F. T. Neal flew last week from Johannesburg to Capetown and back, a distance of 1,580 miles, in the one day, the double flight taking 14½ hours.

### *U.S. "Air Derby" Postponed?*

It is reported from Washington that the proposed "Air Derby" from Washington to South America and back has been postponed until April next year. It is, however, hoped that the rules will be formally announced and entries accepted in about two months' time.

### *Wrecked in the Arctic*

A Russian aeroplane, with pilot, mechanic and two passengers made a forced landing near Archangel on or about February 1. The occupants were marooned on marshland for nineteen days; three of them, including the pilot, after tramping overland, were located and taken half starved to Archangel Hospital. One of the passengers remained in the machine, and relief machines were sent out to his rescue.

### *Australian Rocket Post*

The "rocket post racket" seems to be spreading all over the British Empire. Following the abortive experiments carried out in various parts of the British Isles and in India comes news of an attempt made at Brisbane on December 4, 1934, under the auspices of the Queensland Air Mail Society, in connection with the visit of H.R.H. the Duke of Gloucester to that city. The mail rocket, charged with about 900 letters, was discharged from the S.S. *Canonbar* in the vicinity of Pinkenba, on the Brisbane River, and a special vignette printed in dark purple with a picture of a rocket soaring over a river was affixed to each letter.

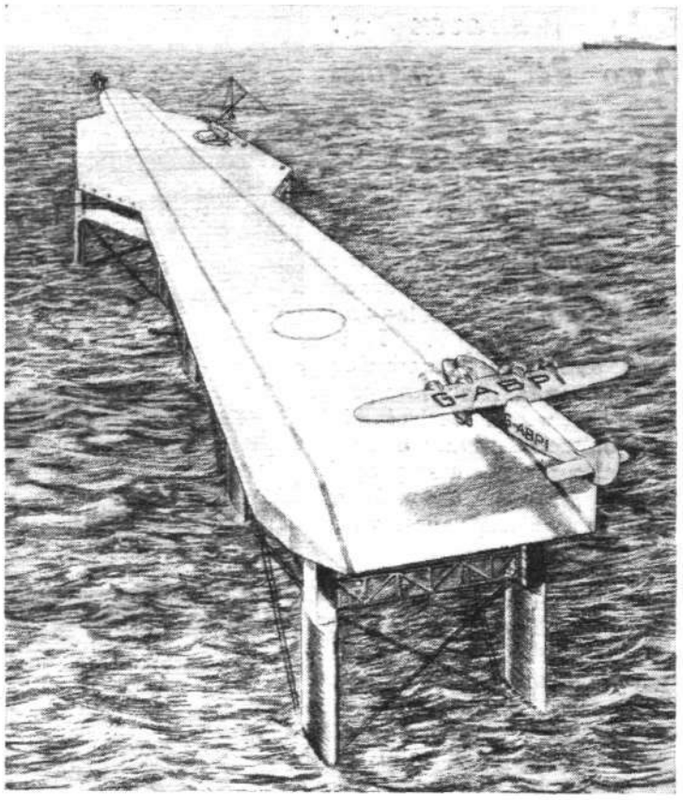
# SEADROMES—SOME PRACTICAL POINTS

## *A Commentary on Further Considerations Dealt with by Mr. G. O. Williams in a Lecture*

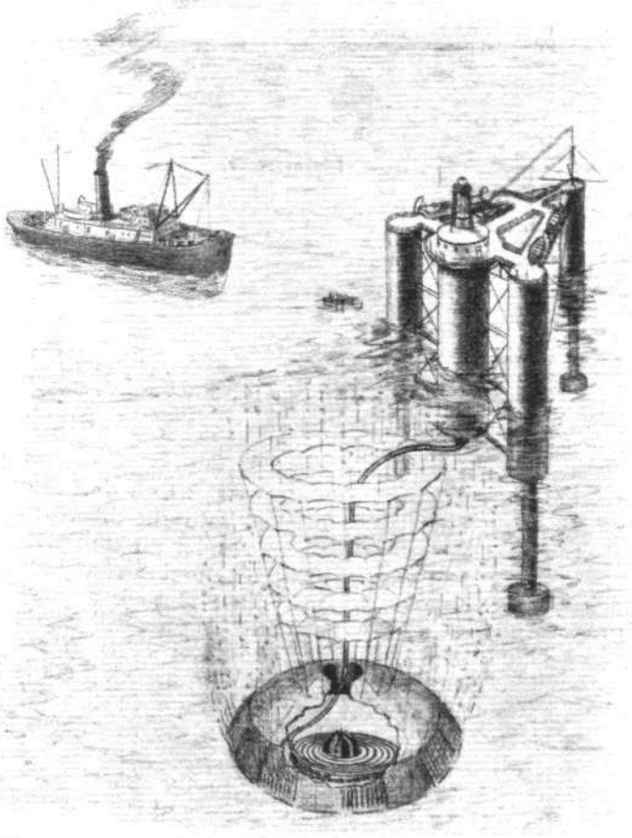
SINCE *Flight*, in the issue of December 20, 1934, gave a considerable amount of detail about the Armstrong "Seadrome," very little that is new concerning this project has been brought to light. However, on February 13 Mr. G. O. Williams lectured on the subject before the Royal United Service Institution, and showed the films which his development corporation has had prepared to prove that its seadrome does not bounce about on the waves in the manner of a ship, and during his talk he brought some new facts to light.

It may come as news to some people that the two end portions of the seadrome (what a horrible corruption and meaningless word!) are to be only 150 ft. wide. Now, that is not very much, because we are fast approaching the time when aeroplanes will commonly have a wing span of well over 100 ft. Every deck-landing pilot knows how easy it is for a swing to start when landing, even with single-engined machines, and it occurs far more easily in the case of multi-engined machines, especially on wet, smooth steel decks of the kind the seadrome will have. Five hundred yards is their length; again, this does not seem very much for the modern, highly loaded, clean machines, particularly for the take-off.

However, these are rather minor points, which may well be changed before the first "island" becomes a *fait accompli*. The lecturer, one felt, was rather prone to cloud the issue and to detract from his own arguments by spending too much time tearing to pieces, as he thought, existing methods of crossing the Atlantic by air. His is such a strong case that it is a pity to spoil it by adopting a hostile attitude to competitors. He is undoubtedly an enthusiast, and he has a right to be; but—to quote only a few examples—it does not do his cause any good to maintain that aeroplanes, to carry the same load in the stratosphere, will have to have twice the wing area; to omit entirely from his remarks any reference to the latest Martin flying boat; or, when talking of the range of flying boats, to say that the Sikorsky S.42 cannot fly between Bermuda and the Azores.




**An artist has here shown an *Atalanta* class machine landing on a seadrome. He has, perhaps, slightly exaggerated the comparative sizes, as the span of this machine is 90ft., but his drawing gives a good idea of what landing-on might involve with, say, a machine of 110ft. span.**



**This drawing shows how the 1,650-ton anchors would be braked, during their descent, by canvas drogues. The seadrome itself will be moored to the triangular buoy, upon which will be carried radio and beacon light equipment.**

No one can deny that, providing the landing charges and dues are not too high, a system which provides refuelling points every 500 miles across the Atlantic must naturally greatly increase the payload which can economically be carried by air on that route. That is the great basic truth of the scheme, which, if the other difficulties can be overcome, makes certain of success.

To our way of thinking, the great difficulty is the question of ownership. Are these "islands" to be international or will they fly the flag of one nation? If so, are they to be armed, or capable of being armed? If not, then what is to prevent their seizure in case of war and their use for military purposes? We are not unduly militaristic, but it is no use blinding ourselves to the fact that the seadromes are virtually islands with the added advantages that they are capable of being moved, and, moreover, will be well stocked with fuel and other valuable material. It should not be impossible to have an international agreement as to their territorial status while still leaving them free, in times of peace, to be operated as a commercial concern by their owners.

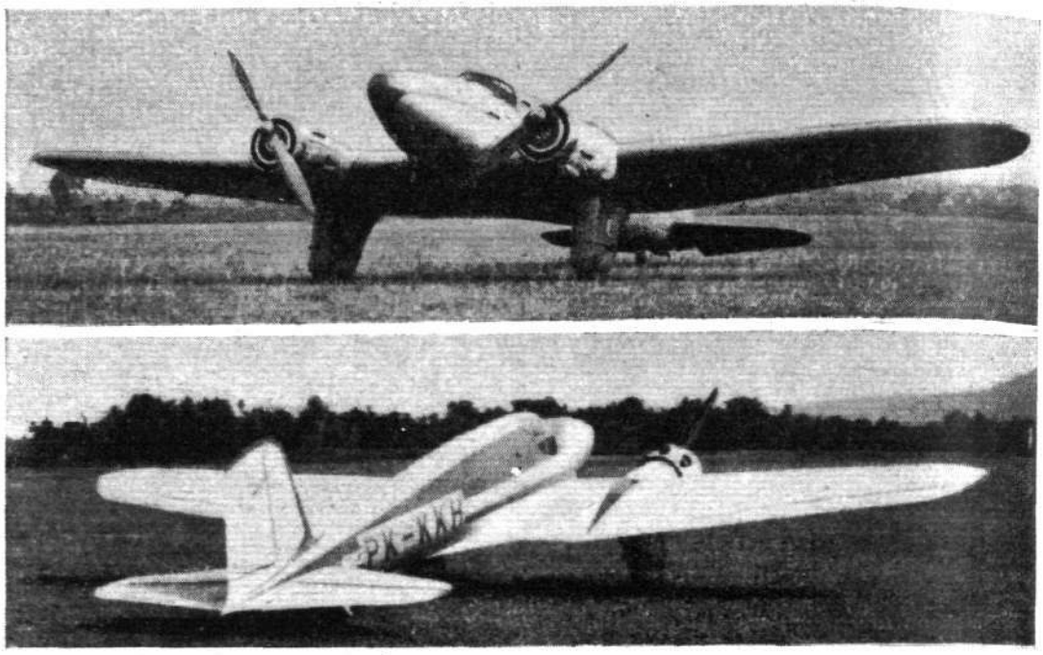
The question of cost, provided it is looked at internationally, does not appear quite so difficult to solve, particularly when it is compared with the cost of ships or airships; for the good of the joint trade of the Americas and Europe it should not be difficult to float an international management corporation.

The technical difficulties of the scheme do not, on the face of it, appear very stupendous. Structurally, the authorities have agreed on its feasibility. Practically, also, the use of aircraft-carriers has shown that it should be workable, but there is one point which does not affect a carrier and which looks as if it might cause trouble, and that is the case where the wind changes quite suddenly after it has been blowing in one direction for a long time. The result would be for the seadrome to swing with the new wind while the waves might continue for some time to have their general trend in the direction of the previous wind. This would mean that they might be at right-angles to the structure and against the streamline section of the supporting columns.

C. N. C.

# BUILT in the DUTCH EAST INDIES

## *The Walraven 2: Two Pobjoy Engines*



The Walraven 2 suggests the "Comet," though actually it was designed earlier.

DESIGNED by a Dutch aeronautical engineer, Mr. L. Walraven, and built at Bandoeng, in the Dutch East Indies, the Walraven 2 has a top speed of 156 m.p.h. and a landing speed of 40 m.p.h. It is an extremely interesting machine, and, if put into production, would be suitable not only for private owners but also for business people who, piloting themselves, wish to fly at high speed with two-engine security.

The designs were completed about a year ago, and the machine constructed during last year. It is powered with two Pobjoy "Niagara" engines, and is designed to have a long range—actually, 1,100 miles in still air. Two people are accommodated, seated side by side.

As can be seen from the photographs, the Walraven 2 is a low-wing, cantilever monoplane; the wings, of Göttingen 681 aerofoil section, are constructed with boxed spruce spars and spruce two-plex plywood ribs, the whole of the wing itself being covered with plywood. The low landing speed—40 m.p.h.—is largely achieved by a flap across the trailing edge of the wing from engine to engine. The fuselage is monocoque, and of oval section.

Transverse frames are interconnected by longitudinal stringers and covered with plywood. The front portion of the fuselage is built up in one piece with the wing, but the rear portion is detachable at the rear wing spar. The tail units are very clean, the tail plane being of pure cantilever construction, and the rudder and elevators of duralumin, with fabric covering. The undercarriage is cantilever, fully faired, and has Palmer wheels and brakes.

The passenger seats are side by side on sliding mountings, and behind them there is a large luggage compartment, while there is also space for luggage in the nose.

This machine has been designed and manufactured throughout to conform to the Dutch East Indies Government requirements, and was constructed for Mr. Khom Kke Hien, a young Chinese.

| | |
|---|---|
| **DIMENSIONS** | |
| Span | 36.1ft. |
| Length | 25.6ft. |
| Height | 7.05ft. |
| Wing area | 190 sq. ft. |
| **WEIGHTS AND LOADINGS.** | |
| Weight empty | 1,380 lb. |
| Pilot and passenger | 340 lb. |
| Fuel and oil | 606 lb. |
| Baggage | 103 lb. |
| Weight loaded | 2,429 lb. |
| Wing loading | 11.3lb. sq. ft. |
| Power loading | 13.5 lb./h.p. |
| **PERFORMANCE** | |
| Max. speed | 156 m.p.h. |
| Cruising speed | 137 m.p.h. |
| Landing speed (with flap) | 40 m.p.h. |
| Range | 1,100 miles |
| Ceiling on one engine | 8,000 feet. |

# GREAT BRITAIN'S CIVIL AEROPLANES

## *A Comprehensive Official Analysis of Machines Registered*

A COMPREHENSIVE analysis of all aeroplanes carrying British registration letters (but excluding those of the Dominions and Colonies) has recently been issued by the Air Ministry, and is reproduced on the next page.

The resulting table embodies a number of most interesting details, which will undoubtedly come as surprises to many people. The table has been reproduced as issued, and it will be seen to include a number of aeroplanes tabulated as registered but not airworthy. In many cases this means that the registration letters have never been cancelled, although the machines in question have long ceased to exist, and it is for that reason that a number of very old types are seen in the list. Other differences between the number of those registered and the number of those airworthy can be accounted for by those machines which are registered and may be either under overhaul or construction, and so do not possess a current C. of A.

The grand total of 937 machines which were airworthy on December 31 last is divided into 101 different types. Of the 80 machines in use on regular air transport there are 20 different types, the highest number of any one type being 20 D.H. "Dragons," then there is a very large drop to nine D.H. four-engined "expresses," followed by eight Handley Page 42's. The total of those used for taxi work, joy riding, and miscellaneous air work is 190, the highest number of any one type in this category being thirty Avro 504 K's, followed by twenty-one D.H. "Fox Moths."

There are 153 machines in use for school work and training, the predominating type being twenty-seven D.H. "Tiger Moths" and twenty-five D.H. "Moths," followed by nineteen Blackburn B.2 trainers, and sixteen Avro "Cadets."

The clubs among them possess ninety-five aircraft, the top score being sixty-eight D.H. "Moths," after which

**Great Britain's Civil Aeroplanes.—**

there is a very big drop to six Avro "Avians." In this connection it should, however, be pointed out that there are many flying clubs which do not possess any machines of their own, but which use those of a flying school run as a separate concern on the same aerodrome, and in this case the machines are listed in the previous category.

Four hundred and seventy eight machines are owned by private persons: 147 are D.H. "Moths," fifty-six are D.H. "Puss Moths," forty are D.H. "Leopard Moths," thirty-four are Avro "Avians," and thirty-three are Miles "Hawks."

There is a grand total of 1,174 registered machines, of which eighteen can probably be discounted, leaving 1,156 as representing our civil aircraft at the end of last year.

| Type of Aircraft. | EMPLOYMENT. | | | | | | | Registered. | Airworthy. |
|---|---|---|---|---|---|---|---|---|---|
| | Regular Air Transport. | Taxi, Joy-Rdg. Photo & Misc. Aerial Work. | Schools, R.A.F. Res. Training. | Clubs. | Demonstration Experimental, Under Cons., Racing, etc. | Private. | Agents for Sale. | | |
| AERONCA C.2 ... ... | — | — | — | — | — | 1 | — | 1 | 1 |
| AIRSPEED: | | | | | | | | | |
| A.S.4 ("Ferry") ... | — | 3 | — | — | — | — | — | 3 | 3 |
| A.S.5 & 5A ("Courier") | 3 | 1 | — | — | 5 | — | 1 | 10 | 7 |
| A.S.6 ("Envoy") ... | — | 1 | — | — | 3 | — | — | 4 | 4 |
| A.S.8 ("Viceroy")... | — | 1 | — | — | — | — | — | 1 | 1 |
| A.L.1 ... ... ... | — | — | — | — | 1 | — | — | 1 | — |
| A.N.E.C.II ... ... | — | — | — | — | — | 1 | — | 1 | 1 |
| ARMSTRONG-WHITW'H: | | | | | | | | | |
| "Argosy" ... ... | 3 | — | — | — | — | — | — | 3 | 2 |
| "Atlas" ... ... | — | — | 4 | — | 2 | — | — | 6 | 1 |
| "Siskin" ... ... | — | — | 1 | — | — | — | — | 1 | 1 |
| XV ("Atalanta") ... | 6 | — | — | — | — | — | — | 6 | 6 |
| XVI ... ... ... | — | — | — | — | 2 | — | — | 2 | 1 |
| ARROW "Active" ... | — | — | — | — | — | 2 | — | 2 | — |
| AVRO: | | | | | | | | | |
| Autogiro C.30A ... | — | — | 6 | 1 | 2 | 8 | 3 | 20 | 17 |
| "Avian" ... ... | — | 2 | 9 | 6 | 2 | 34 | 3 | 56 | 51 |
| Mailplane ... ... | — | — | — | — | 1 | — | — | 1 | — |
| V ... ... ... | — | — | 1 | — | — | — | — | 1 | 1 |
| X ... ... ... | — | 2 | — | — | — | — | — | 2 | 2 |
| Type 504K ... ... | — | 30 | — | — | — | 3 | 1 | 34 | 11 |
| Type 504N ... ... | — | 9 | 1 | — | — | 2 | — | 12 | 10 |
| Type 548 ... ... | — | 5 | — | — | — | — | — | 5 | 5 |
| Type 552 ... ... | — | 3 | — | — | — | — | — | 3 | 1 |
| Type 621 ("Tutor") | — | — | — | — | 2 | — | — | 2 | — |
| Type 626 ("Trainer") | — | — | 3 | — | 3 | 1 | — | 7 | 5 |
| Type 631 ("Cadet") | — | 1 | 16 | 2 | 1 | 2 | — | 22 | 18 |
| Type 638 ("Club Cadet") ... ... | — | — | 7 | 1 | — | 2 | 2 | 12 | 12 |
| Type 639 ("Cabin Cadet") ... ... | — | — | — | — | — | — | 1 | 1 | — |
| Type 640 ("Cadet" 3-seater) ... ... | — | 7 | — | — | 1 | — | — | 8 | 6 |
| Type 641 ("Commodore") ... ... | — | — | — | — | — | 2 | 3 | 5 | 4 |
| Type 642 ... ... | — | 1 | — | — | — | — | — | 1 | 1 |
| Type 643 ("Cadet Trainer")... ... | — | — | — | — | — | 2 | 1 | 3 | 1 |
| Type 652 ... ... | — | — | — | — | 2 | — | — | 2 | — |
| Type 660 ... ... | — | — | — | — | 1 | — | — | 1 | — |
| BELLANCA Monoplane... | — | — | — | — | — | 1 | — | 1 | 1 |
| BLACKBURN: | | | | | | | | | |
| "Bluebird" ... | — | 3 | — | 2 | — | 9 | — | 14 | 9 |
| B.2 ("Trainer") ... | — | — | 19 | — | — | — | — | 19 | 18 |
| "Lincock"... ... | — | 1 | — | — | — | — | — | 1 | 1 |
| "Segrave"... ... | — | — | — | — | 1 | — | — | 1 | 1 |
| Single-Spar "Segrave" | — | — | — | — | 1 | — | — | 1 | — |
| BOULTON PAUL: | | | | | | | | | |
| 2-seater ("Phœnix") | — | — | — | — | 1 | — | — | 1 | — |
| P.71A ... ... | — | — | — | — | 2 | — | — | 2 | 2 |
| BRISTOL: | | | | | | | | | |
| "Bulldog" ... ... | — | — | 4 | — | — | — | — | 4 | 1 |
| "Fighter" ... ... | — | 8 | — | — | — | 6 | — | 14 | 4 |
| Type 118 ... ... | — | — | 1 | — | — | — | — | 1 | — |
| Training Biplane ... | — | — | 4 | — | — | — | — | 4 | — |
| CHEEL ... ... ... | — | — | — | — | 1 | — | — | 1 | — |
| CIERVA Autogiro ... | — | 2 | 6 | — | 1 | — | — | 9 | 8 |
| CIVILIAN "Coupe" ... | — | — | — | — | — | 1 | 1 | 1 | 1 |
| CLARKE "Cheetah" ... | — | — | — | — | — | 1 | — | 1 | — |
| COMPER: | | | | | | | | | |
| "Kite" ... ... | — | — | — | — | 1 | — | — | 1 | 1 |
| "Mouse" ... ... | — | — | — | — | 1 | — | — | 1 | 1 |
| "Streak" ... ... | — | — | — | — | 1 | — | — | 1 | 1 |
| "Swift" ... ... | — | — | — | — | — | 13 | 2 | 15 | 9 |
| DESOUTTER ... ... | — | 5 | — | 4 | — | 6 | 1 | 16 | 12 |
| DE HAVILLAND: | | | | | | | | | |
| D.H.6 ... ... | — | 2 | — | — | — | — | — | 2 | — |
| D.H.9 and 9J ... | — | 2 | 2 | — | — | — | — | 4 | 1 |
| D.H.53 ... ... | — | — | — | — | — | 2 | — | 2 | 1 |
| D.H.60 (all types of "Moth") ... | — | 14 | 25 | 68 | 2 | 147 | 14 | 270 | 242 |
| D.H.66 ("Hercules") | 1 | — | — | — | — | — | — | 1 | 1 |
| D.H.75 ("Hawk Moth") ... | — | 1 | — | — | — | — | — | 1 | 1 |
| D.H.80A ("Puss Moth") ... | 3 | 10 | 3 | 3 | 3 | 56 | 10 | 88 | 80 |
| D.H.82 ("Tiger Moth") ... | — | 2 | 27 | 3 | — | 2 | — | 34 | 33 |
| D.H.83 ("Fox Moth") | 5 | 21 | — | 1 | 1 | 6 | 1 | 35 | 31 |
| D.H.84 ("Dragon") | 20 | 12 | — | — | 2 | 4 | 5 | 43 | 42 |
| D.H.85 ("Leopard Moth") ... | — | 2 | — | — | 2 | 40 | 4 | 48 | 46 |
| D.H.86 ("Express") | 9 | — | — | — | — | — | — | 9 | 3 |
| D.H.87 ("Hornet Moth") ... | — | — | — | — | 1 | — | — | 1 | 1 |
| D.H.88 ("Comet") ... | — | — | — | — | 2 | — | — | 2 | 2 |
| D.H.89 ("Rapide") | 2 | 1 | — | — | 2 | 2 | — | 7 | 5 |
| FAIREY: | | | | | | | | | |
| "Fox" IIIF ... ... | — | — | — | — | 2 | — | — | 2 | 1 |
| | — | — | — | — | — | 1 | — | 1 | 1 |

| Type of Aircraft. | EMPLOYMENT. | | | | | | | Registered. | Airworthy. |
|---|---|---|---|---|---|---|---|---|---|
| | Regular Air Transport. | Taxi, Joy-Rdg. Photo & Misc. Aerial Work. | Schools, R.A.F. Res. Training. | Clubs. | Demonstration, Experimental, Under Cons., Racing, etc. | Private. | Agents for Sale. | | |
| FOKKER: | | | | | | | | | |
| "Universal" ... | — | 1 | — | — | — | — | — | 1 | 1 |
| F.VII ... ... | — | 1 | — | — | — | — | — | 1 | 1 |
| F.VIIIB. Sm. ... | — | — | — | — | — | 1 | — | 1 | 1 |
| FORD: | | | | | | | | | |
| 4A.T. ... ... | 1 | — | — | — | — | — | — | 1 | — |
| 5A.T. ... ... | 1 | — | — | — | — | 1 | — | 2 | 2 |
| GRANGER Monoplane ... | — | — | — | — | 1 | — | — | 1 | — |
| HANDLEY PAGE: | | | | | | | | | |
| 42 ("Hannibal" and "Heracles") ... | 8 | — | — | — | — | — | — | 8 | 6 |
| "Clive" ... ... | — | 1 | — | — | — | — | — | 1 | 1 |
| "Hare" ... ... | — | 1 | — | — | — | — | — | 1 | — |
| HAWKER: | | | | | | | | | |
| "Fury" ... ... | — | — | — | — | 1 | — | — | 1 | 1 |
| "Hart" ... ... | — | — | — | — | 1 | — | — | 1 | 1 |
| "Tomtit" ... ... | — | — | — | — | 4 | 1 | — | 5 | 4 |
| HENDY: | | | | | | | | | |
| "302" ... ... | — | — | — | — | — | 1 | — | 1 | — |
| 3308 ("Heck") ... | — | — | — | — | 1 | — | — | 1 | — |
| "Hobo" ... ... | — | — | — | — | 1 | — | — | 1 | 1 |
| HESTON AIRCRAFT Co.: | | | | | | | | | |
| "Phœnix" ... | — | — | — | — | 1 | — | — | 1 | — |
| JUNKERS F.14 ... | — | 1 | — | — | — | 1 | — | 2 | 1 |
| KAY Gyroplane ... | — | — | — | — | 2 | — | — | 2 | — |
| KLEMM: | | | | | | | | | |
| (German Manufacture) | — | 2 | — | — | — | 13 | 5 | 20 | 16 |
| "Eagle" B.K.1 ... | — | — | — | — | 2 | 2 | — | 4 | 4 |
| "Swallow" ... | — | 2 | 3 | — | 1 | 11 | 4 | 21 | 20 |
| K.P.2 ... ... ... | — | — | — | — | 1 | — | — | 1 | — |
| LOCKHEED "Vega" ... | — | — | — | — | 1 | — | — | 1 | — |
| LE PARMENTIER: | | | | | | | | | |
| Monoplane ... ... | — | — | — | — | 1 | — | — | 1 | — |
| MARTLET ... ... | — | — | 1 | — | — | 4 | 1 | 6 | 4 |
| MARTINSYDE A.V.1 ... | — | 1 | — | — | — | — | — | 1 | — |
| MILES: | | | | | | | | | |
| "Falcon" ... ... | — | — | — | — | — | 1 | — | 1 | 1 |
| "Hawk" ... ... | — | 4 | — | — | — | 33 | 1 | 47 | 40 |
| "Satyr" ... ... | — | — | 5 | 2 | 2 | 1 | — | 1 | 1 |
| MONOSPAR: | | | | | | | | | |
| S.T.4 ... ... | 2 | 2 | — | — | — | 8 | 1 | 13 | 10 |
| S.T.10 ... ... | — | — | — | — | — | 1 | — | 1 | 1 |
| PARNALL: | | | | | | | | | |
| "Elf" ... ... | — | — | — | — | — | 1 | — | 1 | 1 |
| "Peto" ... ... | — | — | — | — | — | 1 | — | 1 | — |
| "Pixie" ... ... | — | — | — | — | — | 1 | — | 1 | — |
| PERCIVAL: | | | | | | | | | |
| "Gull" ... ... | — | 3 | — | — | 5 | 7 | 2 | 17 | 17 |
| "Mew Gull" ... | — | — | — | — | 1 | — | — | 1 | 1 |
| REDWING ... ... | — | — | 2 | 1 | 1 | 3 | — | 7 | 5 |
| R.A.E.: | | | | | | | | | |
| Aero Club Monoplane | — | — | — | — | 1 | — | — | 1 | — |
| SAUNDERS ROE: | | | | | | | | | |
| "Cloud" ... ... | 1 | — | — | — | 1 | 1 | — | 3 | 3 |
| "Cutty Sark" ... | — | 2 | 2 | — | — | — | 1 | 5 | 2 |
| "Windhover" ... | 1 | — | — | — | — | — | — | 1 | — |
| S.E.5.A... ... | — | 4 | — | — | — | — | — | 4 | 1 |
| SHACKLETON AND MURRAY Monoplane | — | — | — | — | — | 1 | — | 1 | 1 |
| SHORT: | | | | | | | | | |
| "Calcutta"... ... | 4 | — | — | — | — | — | — | 4 | 1 |
| "Kent" ... ... | 3 | — | — | — | — | — | — | 3 | 2 |
| "Scion Senior" ... | — | — | — | — | 1 | — | — | 1 | — |
| "Scion" ... ... | — | 1 | — | — | — | — | — | 1 | 1 |
| "Scylla" Class ... | 2 | — | — | — | 5 | — | — | 6 | 3 |
| SIKORSKY: | | | | | | | | | |
| S.38B ... ... | — | — | — | — | — | 1 | — | 1 | 1 |
| S.39A ... ... | — | — | — | — | — | 1 | — | 1 | — |
| SLYMPH ... ... | — | — | — | — | 1 | — | — | 1 | — |
| SPARTAN ... ... | 1 | 7 | 1 | 1 | 1 | 7 | 5 | 23 | 16 |
| "Arrow" ... ... | — | — | — | — | 1 | 6 | 4 | 11 | 8 |
| "Clipper" ... ... | — | — | — | — | 1 | — | — | 1 | 1 |
| "Cruiser" ... ... | 4 | 1 | — | — | 1 | — | 2 | 8 | 7 |
| STINSON ... ... | — | — | — | — | — | 3 | — | 3 | 3 |
| SUPERMARINE "Segaull" | — | — | — | — | — | — | 1 | 1 | — |
| T.K.1 ... ... ... | — | — | — | — | 1 | — | — | 1 | 1 |
| VICKERS: | | | | | | | | | |
| "Vellox" ... ... | — | — | — | — | — | 1 | — | 1 | 1 |
| "Viastra" ... ... | — | — | — | — | — | 1 | — | 1 | 1 |
| "Vildebeest" ... | — | — | — | — | — | 1 | — | 1 | — |
| WACO ... ... ... | — | — | — | — | — | 1 | — | 1 | 1 |
| WESTLAND: | | | | | | | | | |
| Autogiro C.L.20 ... | — | — | — | — | 1 | — | — | 1 | — |
| "Wallace" ... ... | — | — | — | — | 1 | — | — | 1 | — |
| "Wessex" ... ... | — | 4 | — | — | 1 | — | — | 5 | 5 |
| "Widgeon" ... ... | — | — | — | — | — | 4 | — | 4 | 2 |
| "Wood Pigeon" ... | — | — | — | — | — | 1 | — | 1 | — |
| Total ... ... | 80 | 190 | 153 | 95 | 99 | 478 | 79 | 1,174 | 937 |

# LOOKING AHEAD

## *An Appeal by Rear-Admiral Sir Murray Sueter for Greater All-round Encouragement for British Aviation*

THE Editor has received the following communication from Rear-Admiral Sir Murray Sueter, C.B., M.P., Chairman of the Parliamentary Air Committee:—

*Sir,*—Would you permit me to suggest that one of our good resolutions in Jubilee Year is that henceforth we shall as a nation give to British aviation, upon which so much of our future happiness and security depends, the encouragement of public appreciation and public support? We have disparaged our air achievements long enough. We stand with a megaphone on a housetop when an air liner is slightly delayed or when we have an opportunity of giving a flying hotel all the credit for an air race to Australia—that it loses does not matter. But when figures are published, as they were a day or two ago, showing that during 1934 our air liners carried more passengers to and from the Continent than the combined fleets of other European nations, we keep a grim silence.

Far too little attention is, in my view, paid to the concrete achievements of those responsible for our flying expansion and too much attention to anything which seems to disparage those achievements. The laudation of our very worthy rivals, the Dutch, to the detriment of our own prowess in winning the Australia Race, was a case in point. National modesty is one thing; when it tends definitely to disparage enterprise and mislead the public it is another.

I am not claiming that we are perfect. Far from it. I shall, if you will permit me, suggest a few directions in which our civil aviation system might be improved. But I do maintain that it compares for safety with that of any nation in the world. None has finer pilots. None covers such a vast range with greater regularity than Imperial Airways, to whom be all praise. All that is now required is to raise the speed of their machines with more frequent services on our Empire air routes and extend these routes wherever possible.

Destructive criticism has no influence on the instructed mind. But too much of it creates a feeling of uneasiness that all is not well with our Air Force and civil aviation, and detrimentally affects our export trade in machines by decreasing confidence overseas. Yet there is no industry that works harder or produces finer results than that of British aircraft.

### *Second to None*

I feel certain that those, like myself, who helped to guide our industry during the War years will agree that, no matter how difficult the problem we set them, the aircraft industry never once failed us, whether it was turning out high-performance machines, bombers, torpedo-carrying aircraft, or airships.

Our aircraft industry to-day is still second to none. If it is informed in a clear way what it is required to do, it will not fail us. This is shown by its production of high-speed Schneider Cup machines, large boat-type seaplanes, and the machine which (with the most meagre acceptance tests) won the England-to-Australia race.

Of late the Air Ministry has been giving the air industry a much freer hand, but even now many think it is hampered by too much restriction. Specifications should be clipped. In our present state of air development there is no sense in issuing pages and pages of specifications.

The specification for the first Sopwith torpedo aeroplane—hundreds were ordered towards the end of the War—consisted of five lines.

The question is, however, often asked how it is that the Americans have forged ahead of us in obtaining better performance with their latest machines. The answer is simple. The fault does not lie at the door of our own industry. During the War we accumulated in Britain a large amount of air technique, thanks to the hard work of our skilled scientists. This, with our best machines, was placed freely at the disposal of the Americans during the War. We did the spade-work and they reaped the benefit at very little cost.

In order that the American inland air services should compete against their own railway system, they have to be fast. Comfort is a secondary consideration, whereas Imperial Airways have to operate over "backward" countries and must provide comfort.

The Americans have the inestimable advantage of operating chiefly within their own country. They have no great difficulties with regard to different languages, currencies, Custom duties, immigration laws, etc. Unlike Imperial Airways, they have not to ask other countries for permission to fly. In South America, Pan-American Airways are welcomed everywhere.

After the War we had to economise, while America expended millions and millions of dollars of taxpayers' money in developing their air routes not only across the United States but on both sides of South America. Money was lavishly spent on research work. A full-sized wind tunnel was provided and much aerodynamic research was conducted. We might profitably do a little more in the same direction.

The results are shown in their very efficient streamline all-metal machines with retractable undercarriages, variable-pitch propellers, etc., as shown in the Douglas and Boeing types of aeroplanes. Also, much research work has been done in connection with wing flaps to steepen the angle of glide and reduce the stalling speed when landing.

It is true that we very wisely pursue a policy of putting safety and reliability before the attainment of mere spectacular feats of speed. Even so, I suggest we would be wise to build a full-sized wind tunnel, as the United States have done at Langley Field, and the French at Chalais-Mendoi, for aerodynamical research work. The wind tunnel at Farnborough is on the small side.

### *Theory and Practice*

Our scientists have done well, but—and I say this in a constructive and not a critical spirit—is not their work a little too academic? In the past I have freely criticised Farnborough in the House of Commons, and I am still of the opinion that there is too much of a gap between the scientific achievements of that establishment, research work elsewhere, and what is really required to produce high-performance aircraft of great efficiency.

Research work, to be of value, must find its way to the productive side of industry. It is short-sighted policy to reach great heights in tabulating scientific data that nobody wants or uses.

It is now for our very able Director of Aeronautical Research and his staff to go one better than the research laboratories in America and give to the air industry that practical help that is needed to bring into production the best machines in the shortest possible time.

Another point—and a complex one—is whether we have not too many firms engaged in the aircraft industry. Those who have visited Germany lately inform me that aircraft production is wholly in the hands of some six firms, whereas we in this country have over double that number. Some rationalisation might be undertaken.

Our aircraft industry cannot complain of lack of encouragement by the Post Office. It should develop greatly in the near future by the wise foresight of Sir Kingsley Wood in laying down that all first-class mail matter should be sent by air at a low flat rate not only in this country but to all parts of the Empire, where delivery will be accelerated.

### *The Air-minded G.P.O.*

It is gratifying to note that in the last two years the number of letters carried by air has risen from four million to six million, and, as this country becomes more air-minded, no doubt more and more air mails will be carried.

If our great Departments would become as air-minded as the G.P.O.; if our great industrialists would become—and insist on their employees becoming—air-minded and send their representatives to all parts of the world by air; above all, if more attention is paid to our achievements and less to vicious self-depreciation we would not merely establish our prestige among the nations of the world but also would solve many of our employment problems. To the question, "What can we do with the boys who leave school?" we could reply, "Send them into the expanding aircraft industry."

Fundamentally, however, our prestige in the air depends on public opinion and the checking of our insane instinct for self-immolation. Let us for a change realise and repeat that we have comparatively and potentially the best civil aviation service of any nation.

(Signed) MURRAY F. SUETER.

February 28, 1935

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# THE R.A.E. TANK*

*Tests for Interference : Large Models Found Practicable : Four-wire Suspension System : Accelerated Motion Tests : Dynamically-similar Models*

By L. P. COOMBES, B.Sc., A.C.G.I.

IN the introduction to his paper, Mr. Coombes recalled that seaplane tank testing was an offshoot of ship tank testing, the technique of which was founded by William Froude nearly 70 years ago. Apart from the fact that a scale model was towed through still water there was now little in common between the two systems of test, the one remaining link being Froude's laws, which were still used as a basis of correlation between model and full scale.

The dimensions of the new R.A.E. tank were fixed by a small committee. The size of tank recommended by the committee is compared, in the following table, with two other tanks built abroad at about the same time.

| Tank. | Length. ft. | Width. ft. | Depth. ft. | Max. Speed of Carriage. |
|---|---|---|---|---|
| R.A.E., England .. | 650 | 9 | 4.5 | 40 ft./sec. |
| H.S.V.A., Germany .. | 1,050 | 16.5 | 8.3 | 66 .. |
| N.A.C.A., U.S.A. .. | 1,980 | 24 | 12 | 88 .. |

Two immediate problems awaited consideration when the tank was finished. The first was the calibration of the tank with reference to the size of model it was possible to test in it, and to find what corrections, if any, were to be applied to the results in order to predict the performance of the full-size machine. The second problem was the review of existing methods of testing in order to decide whether or not a new technique of testing should be developed. A four-wire suspension of the model was decided upon. Two wires at the centre gravity supported the model laterally, while fore-and-aft wires determined the attitude in pitch. For simplicity it could be considered that the two c.g. wires counterbalanced the excess weight of the model, while the fore-and-aft wires applied the wing lift and the pitching moment due to wings, tailplane and thrust.

The c.g. wires had counterbalance weights, while the fore-and-aft wires were attached to air pistons in which the air pressure could be accurately controlled. The pistons were air-lubricated and worked with very little friction. The damping in pitch due to constraint by the air pistons had a stabilising action on the models, and it was possible to run even quite unstable models without the necessity of restraining the oscillations by hand. The drag balance was also pneumatic.

### *Wall Interference*

When the balances had been installed, the first problem to be attacked was that of finding the limitations of the tank as regards size of model. Wall interference was measured first, the method employed being to run first one and then two similar models abreast, spaced half the width of the tank apart. Finally, three similar models were spaced one-third the width of the tank apart. The size of model used was 4.5ft. long, i.e., the length was half of the width of the tank. The tests showed that models up to 1.5 times the width of the tank, i.e., 13.5ft. long, could be tested without side-wall interference, provided that the water was as deep as the model was long. For twin floats spaced half their length apart the limiting length would be slightly over 7ft. Later tests on a twin-float model indicated that twin floats could be spaced quite close together without mutual interference, none being found with floats spaced less than half their length apart.

Tank tests on depth effects indicated that unless it were taxying at about the critical velocity a flying-boat would not experience any appreciable depth effects in taking off from shallow water.

### *Scale Effect*

Having determined that it was safe to test models up to 9ft. long, three models were made to the same lines, these being 3, 4.5, and 9ft. long respectively, the corresponding scales being 1/18th, 1/12th, and 1/6th for a large flying-boat. The same series of tests were carried out on each model. The results showed that scale effect was small at low and high speeds and reached a maximum

* Summary of Paper read before the R.Ae.S. on Feb. 22 1935.

at the hump. As part of the scale effect research, the effect of rivets, lap joints, chine angles, etc., were represented to scale on the 1/6th scale model. A small increase of resistance throughout the speed range was found, but the effect was so small as to be negligible in practice, a result which was in accord with calculations previously carried out and which had indicated that skin friction was a very small proportion of the total drag.

In order to check the model results obtained in the tank, a slightly more than half full size model hull to the same lines as those of the tank models had been constructed, and would be tested at Felixstowe on the seaplane fitted with a force-recording undercarriage capable of measuring the water forces on a large-scale float.

One difference between tests in a tank and actual take-off conditions appeared worthy of study. This was the effect of acceleration on the forces. From full-scale tests made at Felixstowe it appeared that the "virtual-mass" effect was small. From the point of view of the Farnborough tank it was desired to make a certain number of tests in accelerated motion, not only to clear up this point but also in order to develop a method of covering a range of speeds in one run. The drag in accelerated motion was measured by the aid of a pendulum connected by a system of levers to the drag balance. The length of this pendulum was adjustable, so that the effect of acceleration on it would be exactly equal and opposite to the effect on the mass of the model. Thus, the drag balance measured water drag only, taking no account of the large forces needed to accelerate a heavy model. The tests indicated that acceleration effects on drag and immersion were very small and could safely be neglected.

The lecturer pointed out that it was the practice at the R.A.E. to tow the model through the centre of gravity and not through the thrust line. In an actual flying-boat the thrust moment was offset by slipstream effects, being entirely balanced at the moment of take-off. They preferred to calculate thrust moments and apply them with the air pitching moments.

## *Improvement of Hull Design*

The Farnborough tank had been in operation for two years, and the basic research work described, together with a considerable proportion of time spent on development work, had not left much time yet for progress. It was the opinion of the lecturer that improvement of design would only follow systematic tests of families of models. One investigation was carried out which is of general interest. This dealt with the use of stubs or sponsons for the lateral stabilisation of hulls on the water. Experience with these stabilisers was very limited in this country. The investigation started with stubs of the Dornier type, which were tested on two hulls of similar design, one having rather flat vee sections following Dornier's design, and the other having more acute angles in conformity with British practice. The tests showed that there was no inherent reason why stubs should not be successful on quite deep vee-bottom hulls.

It was found that the general characteristic of stubs was that they interfered markedly with the bow-wave system at a speed of from 10 to 14 knots, and so introduced a wave interference hump into the resistance curve. The stubs were attached at various fore-and-aft positions, and the height above or below the water-line, as well as the angle of attack, was varied. Height of stub was found to be more important from a lateral stability point of view. If the sponsons were placed above the water-line the hull was initially unstable. [This is interesting in view of the fairly high placing of the stubs used on the latest large Latécoère flying-boat.—ED.] The effect of a stub below the water-line was to produce a sort of elongated resistance hump which actually seemed to reduce the normal hump resistance.

From the tests on fore-and-aft position of stubs it was found that the best setting was a compromise between low resistance (which demanded a position well forward, and a setting above the water-line at a large angle of attack) and lateral stability, which required a medium position and medium angle of setting and a height somewhat below the water-line. A better compromise was obtained by sweeping back the stubs in plan form.

The modifications tested in the tank were afterwards tried in the wind tunnel to find their effect on air performance, as air drag was one of the main objections to stubs. The actual positioning of the stubs was found to have only a minor effect on top speed, and the penalty for fitting stubs instead of wing tip floats on this particular design was about 2½ m.p.h. Allowing for the fact that it might be possible slightly to reduce the main wing area if the stubs gave a certain amount of lift at high angles, it might be possible to design stubs with a lower drag and slightly higher speed. The greatest improvement in air drag of stubs was achieved by better aerodynamic design and by fining down the trailing edge.

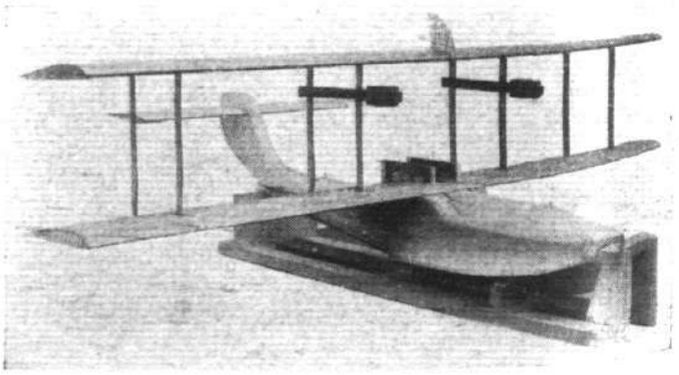
Of the longitudinal instability known as porpoising Mr. Coombes said this was still a problem for the designer, as up to now no hard-and-fast rules for its avoidance had been laid down. At the R.A.E. the problem was attacked from two points of view: analytically and experimentally. It was found that the assumptions which had to be made in the mathematical work were too crude, and that before any survey could be made the derivatives would have to be measured for actual hulls. Until tests could be made the mathematical side had been side-tracked.

## *Dynamic Models*

Mr. Coombes concluded his paper with the following remarks:—

"Another fact which emerged from the theory was that model experiments could not be relied upon unless the air structure was represented. Dynamically similar models complete with wings and tailplane of approximately the correct proportions are therefore used. The models are made of balsa wood, waterproofed and strengthened as necessary, and are of the correct mass and moment of inertia. They are towed by a special fitting which allows freedom in rise and pitch, but prevents yawing or rolling. The technique of making and testing such models has been developed so that any important design can be vetted in the model stage, and, if necessary, alterations made and tried to eradicate any tendency to instability. In the course of testing these models it has been found that seaplanes have a certain range of angles within which they are stable. If trimmed too far nose down or tail down, porpoising occurs. These angular limits vary with speed, but are well defined as a rule, and do not alter much with change of c.g. position, loading or moment of inertia. This enormously simplifies the testing, which has been boiled down to a relatively simple routine.

"The value of this dynamic model test is fully apparent when an unorthodox design is under consideration. As an extreme example I might quote a recent proposal for a



**A "dynamic" model of a flying boat, as used in the R.A.E. Tank. (*Flight* photograph).**

large tail-less flying boat having a Pterodactyl wing plus stubs, a combination of two experimental features. In the course of the tests we have discovered a few interesting facts about porpoising and its amelioration, but not enough to warrant laying down rules for success. Here is another case where systematic changes as opposed to *ad hoc* tests are desirable, and it is hoped to have time in the near future to start such a series. So far, we have had very little opportunity to compare the results predicted from models with full-scale behaviour, but where this has been done the agreement between model and full-scale is good.

"Seaworthiness tests in a train of waves demand a similar technique to porpoising, and dynamic models are necessary. A wave-maker has been installed in the R.A.E. tank and experiments in this direction have been commenced.

"Another interesting use of dynamic models was in an experiment made in connection with a proposal for impact tests on hulls. By photographing in slow motion the impact of a model in which various alterations were made, e.g., the air structure removed and lift applied by weights, moment of inertia altered, no lift applied, etc., it was possible to say what type of test was desirable in order to give approximately the right motion after impact.

### *Future Research*

"A few words should be said with regard to the work contemplated. Several designers have expressed the view that the unstable yawing moments on certain types of hulls should be investigated. At the same time yawing moments at low speeds are required for water rudder tests, and we are therefore designing a balance to measure yawing moments. The same apparatus will measure rolling moments more satisfactorily than the present crude arrangement and further systematic tests on lateral stabilisers will be made.

"Experiments on changes in hull design in order to improve efficiency have commenced. Some of the changes contemplated are in the direction of unorthodox hull forms, but the effect of altering standard types will also be tried. The study of porpoising is going forward by both analytical and experimental methods. The analysis depends on the evaluation of the stability derivatives, and this is in hand. The most profitable field for experiment is an investigation on dynamic models in which the effect of systematic changes in hull design are correlated with their effects on stability.

"In all the foregoing discussion I have made no reference to development tests, though a large proportion of the tank time is devoted to these. The reasons are obvious, as the results are, in general, confidential and applicable only to the particular design under test. The research methods described are frequently used ultimately in routine tests, as in the case of porpoising where a large proportion of new designs are constructed as dynamic models in order to assess their stability."

# CONTROL SURFACE FLAPS for TRIM and BALANCE

*Generally referred to in America as "Tabs," these Flaps are called "Trimmers" when used Instead of Adjustable Tailplanes, and as "Balances" when their Function is to Reduce Hinge Moments of Control Surfaces*

ALTHOUGH trimming tailplanes are still used on the majority of British aircraft, there is a tendency in the most modern designs to adopt the small trailing-edge flap which has become popular with American designers of recent years. The following article will probably be of interest to British designers. It is taken, with due acknowledgment, from the *Journal of the Aeronautical Sciences*, which is the American "opposite number" to our *Journal of the Royal Aeronautical Society*. It is published by the Institute of the Aeronautical Sciences, Inc.—which corresponds to our R.Ae.S.—and now appears six times per annum. The author of the article is Mr. A. E. Lombard, of the Curtiss Aeroplane and Motor Co., Inc.

Within the past few years (says Mr. Lombard) the application of small flaps to the movable control surfaces of aeroplanes has become extensive. That these flaps give a quick, light and highly effective control is shown by the fact that on the Curtiss-Wright "Condor" a 90 deg. adjustment of the elevator flap control wheel changes the longitudinal trim of the aeroplane as much as 28 turns on the stabiliser adjustment control.

On aeroplanes of more than one engine the control flap on the rudder has proved to be of great assistance to the pilot when flying with one engine dead, and is largely responsible for the fact that modern twin engine aeroplanes can be designed satisfactorily with a single vertical tail. For example, the original Curtiss "Condor," built in 1929–1930, had two fins and rudders, located in the slipstreams from the two propellers to enable straight flight to be maintained on one engine. The new "Condor" is built with a single vertical tail mounted rigidly on the fuselage, and the rudder with its control flap has sufficient power to hold the aeroplane on a straight course with one engine out of commission.

When used to give control in lieu of an adjustable stabiliser or vertical fin the control flap may be called a "trimmer," and when used to reduce the hinge moments of a control surface the term "balance" is appropriate. In the following notes the theoretical formulae for the effect of these flaps are presented as well as the results of wind tunnel tests on several types of trimmers and balances.

### *Nomenclature*

$\alpha_s$ = stabiliser angle, see Fig. 1.
$\delta$ = elevator angle, see Fig. 1.
$\epsilon$ = control flap angle, see Fig. 1.
$c_e$ elevator chord aft of hinge, which includes chord of inset flap.* See Fig. 1.
$c_f$ flap chord aft of hinge.* See Fig. 1.
$c_t$ = overall chord of tail.* See Fig. 1.
$S_e$ = elevator area aft of hinge including area of inset flap.*
$S_f$ = flap area aft of hinge.*
$E_e = c_e/c_t$.
$E_f = c_f/c_t$.
$\beta_e$, $\gamma_e$, $\lambda_e$ = parameters—elevator. See Eqs. (1 and 2).
$\gamma_f$, $\lambda_f$ = parameters—control flap. See Eqs. (1 and 2).
$q$ = dynamic pressure ($= \rho V^2/2$).
$C_L$ = Lift/$qS$.
$C_{H_e}$ = (Elevator hinge moment)/$qc_eS_e$.

* In the case of the tests with the external flaps, see Fig. 8, the elevator chord and area, $c_e$ and $S_e$, do not include the chord and area of the flap. Also, in this case $c_f$ and $S_f$ represent the total chord and area of the flap rather than just the chord and area aft of the hinge.

## *Theoretical Considerations*

On a normal movable control surface that is not overbalanced the moment about the hinge axis necessary to displace the surface from its neutral position increases as the angular displacement of the surface increases. Likewise the moment produced about this hinge axis by displacing the control surface flap increases with the angular displacement of the flap. The effectiveness of the control surface flap is determined by the relative magnitudes of these two moments: the moment due to the surface displacement, and the moment due to the flap displacement.

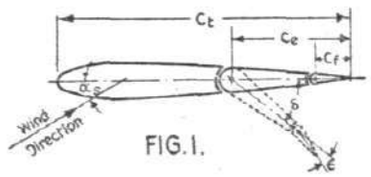
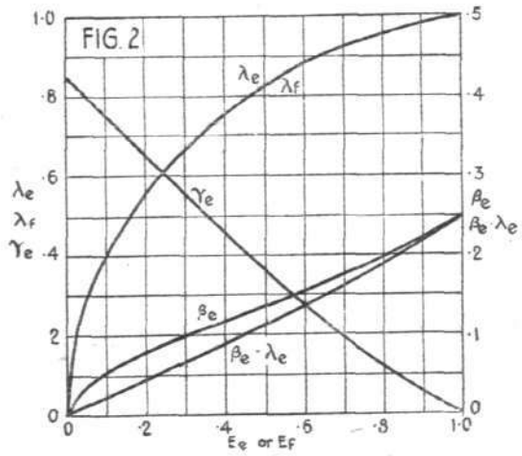
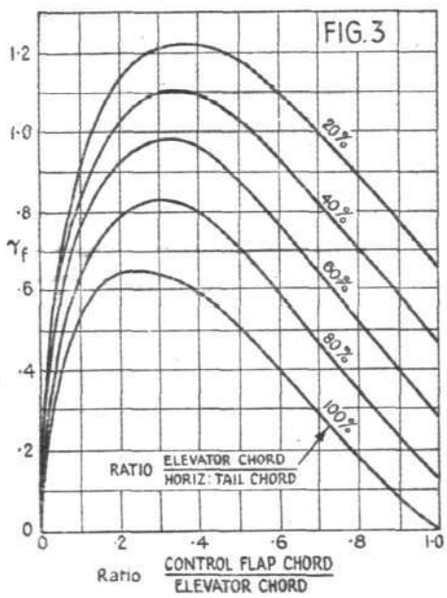



FIG. 1.




In Fig. 1 is given nomenclature for angles and dimensions. Positive angles are shown. Fig. 2, theoretical relations for thin aerofoils at small angles. Elevator and control flap parameters. (Parameters with subscript $e$ are functions of $E_e$; parameters with subscript $f$ are functions of $E_f$). Fig. 3, theoretical relations for thin aerofoils at small angles. Control flap parameter.

A mathematical analysis has been made by Perring[1] in which he derived the theoretical relationships of lift, pitching moment, and hinge moments for thin rectangular aerofoils with multiple hinged flaps at small angles. These theoretical relationships are given below as they would apply to a rectangular horizontal tail system with a stabiliser, elevator, and control flap, each with a full span.

The theoretical equation for the lift coefficient of the tail surface is

$$C_{L_t} = (dC_L/d\alpha)_t(\alpha_s + \lambda_e\delta + \lambda_f\epsilon) \quad .. \quad (1)$$

In the above equation $(dC_L/d\alpha)_t$ is the slope of the lift curve, which is a function of the aspect ratio of the tail. See Higgins' report[2] for the theoretical values of this function.

$\lambda_e$, $\lambda_f$ are functions of $E_e$ and $E_f$, the values of which are given in Fig. 2.

The theoretical equation for the hinge moment of an elevator with a flap extending along its full span is

$$C_{H_e} = -\beta_e C_L - \gamma_e\delta - \gamma_f\epsilon \quad .. \quad (2)$$

$\beta_e$, $\gamma_e$ and $\gamma_f$ are parameters, the values of which are given in Figs. 2 and 3. All angles are expressed in radians.

From Eqs. (1) and (2) above we can derive by partial differentiation expressions for the variations of the elevator hinge moment as independent functions of (1) the elevator angle, and (2) the flap angle.

Due to elevator motion:

$$\partial C_{H_e}/\partial\delta = -\beta_e\lambda_e \,.\, (dC_L/d\alpha)_t - \gamma_e \quad .. \quad (3)$$

Due to control-flap motion:

$$\partial C_{H_e}/\partial\epsilon = -\beta_e\lambda_f \,.\, (dC_L/d\alpha)_t - \gamma_f \quad .. \quad (4)$$

A check of the theoretical values above has been made against actual values obtained in the wind tunnel for models of the Curtiss-Wright "Condor." On the 1/32-scale wind-tunnel model of the complete aeroplane the observed value of $(dC_L/d\alpha)_t = 0.040$/degree. The theoretical value[2] is $(dC_L/d\alpha)_t = 0.063$. For the unbalanced elevator shown in Fig. 5 the variation of hinge moment with elevator angle is $\partial C_{H_e}/\partial\delta$(theoretical) $= -0.012$/degree, $\partial C_{H_e}/\partial\delta$(wind tunnel) $= -0.0078$ at small angles.

On the assumption that the control flap effectiveness is proportional to the control flap span, the change in elevator hinge moment with control flap angles for the elevator flap combination of Fig. 5, in which the flap is approximately 25 per cent. of the effective elevator span, is

$\partial C_{H_e}/\partial\epsilon$(theoretical) $= -0.0048$/degree,
$\partial C_{H_e}/\partial\epsilon$(wind tunnel) $= -0.0025$ at small angles.

[The slope of the tail-lift curve from the wind tunnel is the effective slope. The slope calculated from aerofoil data does not include the tail efficiency.—ED., *Journal of Aeronautical Sciences*.]

Thus we see that observed wind tunnel forces and hinge moments are in general from one-half to two-thirds of the theoretical values. This discrepancy is considered to be due in part to the general reduction in aerofoil efficiencies below their theoretical values and in part to the disturbance caused by the portion of the tail of the fuselage present in all these tests.

The criterion for control flap effectiveness of the elevator-flap combination in Fig. 6 is:

$$(\partial C_H/\partial\epsilon)/(\partial C_H/\partial\delta) = 0.40 \text{ (theoretical)}$$
$$= 0.32 \text{ (wind tunnel)}.$$

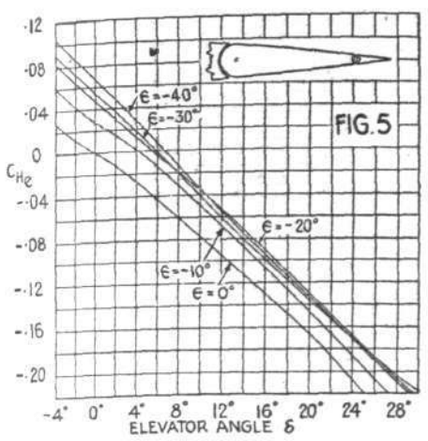
It appears, therefore, that this theoretical value for the control flap effectiveness is in approximate agreement with the observed value in the wind tunnel. This expression for effectiveness is significant because it gives us a measure of the relative motion of the elevator for a given motion of the trimming flap.

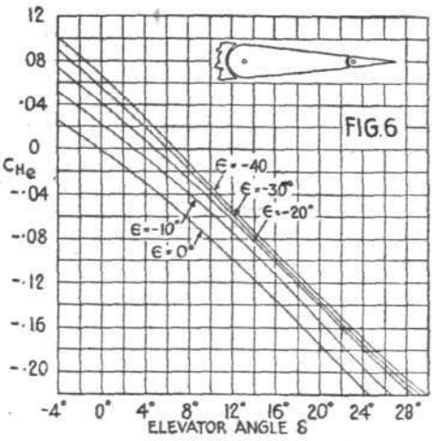
## *Wind-tunnel Tests*

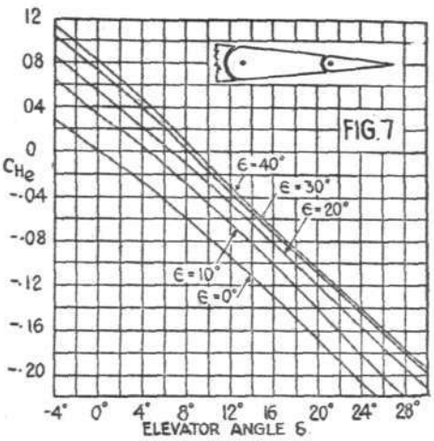
Wind-tunnel tests in the eight-foot open-throat wind tunnel of the Curtiss Aeroplane and Motor Co., Inc., were made of a 1/8-scale model of a horizontal tail for the Curtiss-Wright "Condor." This tail has a symmetrical aerofoil section 9 per cent. thick. The principal full-scale dimensions of this tail surface are:

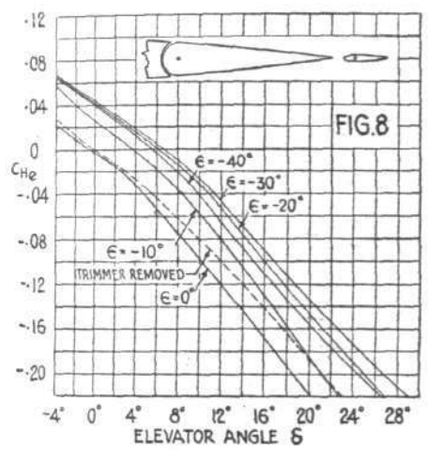
| | |
|---|---|
| Total area, including fuselage | 156 sq. ft. |
| Elevator area aft of hinge | 51 sq. ft. |
| Elevator chord | 28 in. |
| Span | 24ft. 0in. |
| Aspect ratio | 3.7 |

All tests were made at 80 m.p.h. The angle of the flap to the elevator was held constant for each run and hinge moments were measured at various elevator angles. Fig. 4 gives a photograph of the model and set-up. [Not published.—ED.] The results are given in Figs. 5 to 9.



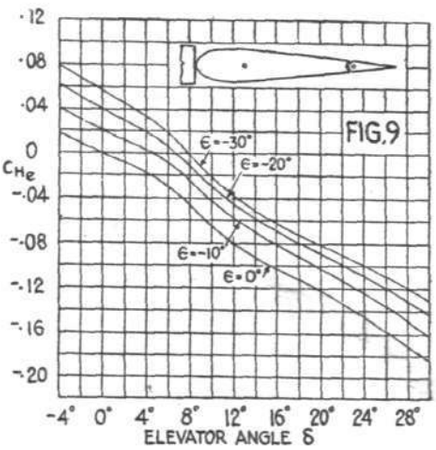




Fig. 5, hinge moments for unbalanced elevator with inset trimming flap fixed to move with elevator. Stabiliser angle $\alpha_s = 0$ deg. ; $c_f/c_e = 0.214$ ; $S_f/S_e = 0.052$. Fig. 6, Stabiliser angle $\alpha_s = 0$ deg. ; $c_f/c_e = 0.285$ ; $S_f/S_e = 0.070$. Fig. 7, $c_f/c_e = 0.429$ ; $S_f/S_e = 0.104$. Fig. 8, hinge moments for unbalanced elevator with external trimming flap to move with elevator. Stabiliser angle $\alpha_s = 0$ deg. ; $c_f/c_e = 0.235$ ; $S_f/S_e = 0.070$. Aspect ratio of flap = 4.0. Fig. 9, hinge moments for balanced elevator with inset trimming flap fixed to move with elevator (Leading edge balance chord 24 per cent. of overall elevator chord) Stabiliser angle $\alpha_s = 0$ deg. ; $c_f/c_e = 0.285$ ; $S_f/S_e = 0.070$.

A comparison of the curves of Figs. 5 to 7 shows the relative effectiveness of several flaps all of the same span. The flap span was held constant in these tests, rather than the aspect ratio, area, or other dimension, because it was felt that the purpose of the flap was to influence the flow of air over that portion of the elevator and stabiliser in front of it and that therefore the total " affected " area should be held constant. It is seen that the narrow-chord flap (Fig. 5), contributed almost the same increase in hinge moment at zero elevator angle as the large chord flap (Fig. 7). This is as would be expected from the theoretical curve (Fig. 3), inasmuch as these flaps have chord ratios between 0.21 and 0.42 and are therefore near the peak of $\gamma_f$. However, at large elevator angles it is seen that the narrow chord flap lost its effectiveness and in fact apparently " stalled " at an angle between 30 and 40 deg. This is considered due to the fact that the narrow chord flap was probably operating in a turbulent wake when the elevator was deflected to large angles as shown in Fig. 10.

In Fig. 8 are given the results of tests of a trimming flap mounted externally behind the elevator. Because of the fact that this external type flap was acting more as an independent aerofoil than as a part of the regular surface its effectiveness was not as high as might have been anticipated at first thought. It is seen that the trimmer definitely stalled at an angle between 30 and 40 deg. The same size flap, but of the inset type, continued to increase the elevator hinge moment up to 60 deg.

Other tests were made of this externally mounted flap still farther back of the elevator and of the flap mounted above and to the rear of the elevator. The results were approximately the same as those of Fig. 8 and are therefore not included.

The flap of Fig. 6 was also tested on an elevator with a leading edge balance. The results are given in Fig. 9. The increment of hinge moment due to the flap in Fig. 9 is approximately the same as that of Fig. 6, which leads to the conclusion which would be expected that the hinge moment due to the flap is independent of the type of aerodynamic balance on the elevator. Additional tests were made of this elevator-flap combination (Fig. 9) with the stabiliser set at 4 deg. to the relative wind. The results are given in Fig. 11, plotted in terms of angle of trim of the elevator, i.e., the elevator angle where $C_{H_e} = 0$.

It is seen in Fig. 11 that the trimming flap is more effective when the elevator is moved to decrease the lift on the stabiliser than when moved to increase the lift. This is advantageous in so far as elevator control flaps are concerned because, in general, at high angles of attack of the aeroplane, the stabiliser is at a positive angle to the relative wind and the up elevator neutralises the lift on the stabiliser.

In Fig. 12 is plotted a curve taken from wind-tunnel tests of the complete model. By using Figs. 11 and 12 it is possible to arrive at the elevator and flap angles necessary to trim the aeroplane in various conditions of flight. These angles are given in Table I.

TABLE I.—*Elevator and flap angles necessary to trim Curtiss-Wright " Condor " in flight (From Wind-Tunnel data Figs. 11 and 12.)*

| *V m.p.h.* | $C_L$ | δ *Elevator* | ϵ *Flap* | ϵ *Flap** |
|---|---|---|---|---|
| | | *Deg.* | *Deg.* | *Deg.* |
| *150* | *0.21* | *1.6* | *−3* | *−1.5* |
| *130* | *.28* | *.8* | *−1* | *+ .5* |
| *100* | *.48* | *−2.4* | *4* | — |
| *90* | *.59* | *−5.9* | *15* | — |
| *80* | *.75* | *−8.5* | *30* | — |

Inasmuch as the control flap angle is very sensitive to the stabiliser angle, the absolute value of these flap angles is only of comparative importance, but it is significant that the control flap motion of 2 deg. derived from the wind-tunnel data as the amount necessary to change the trim

* Flight test data.

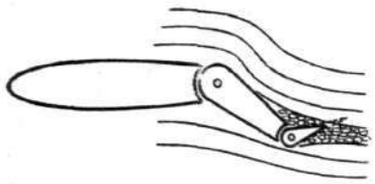
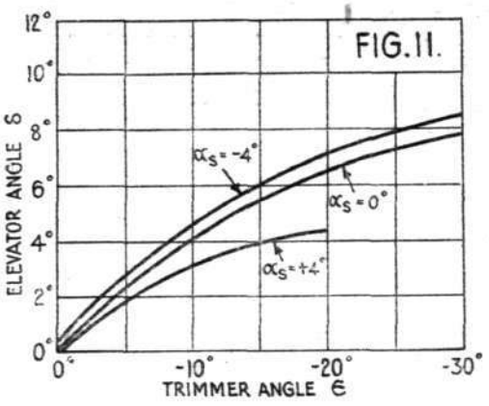
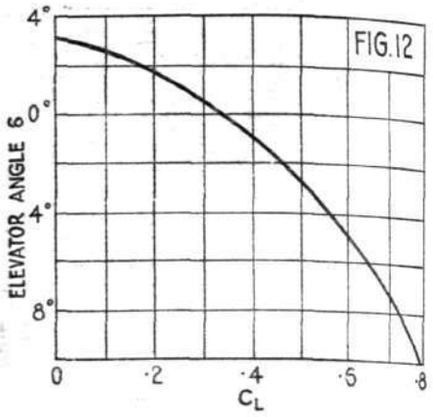


FIG. 10



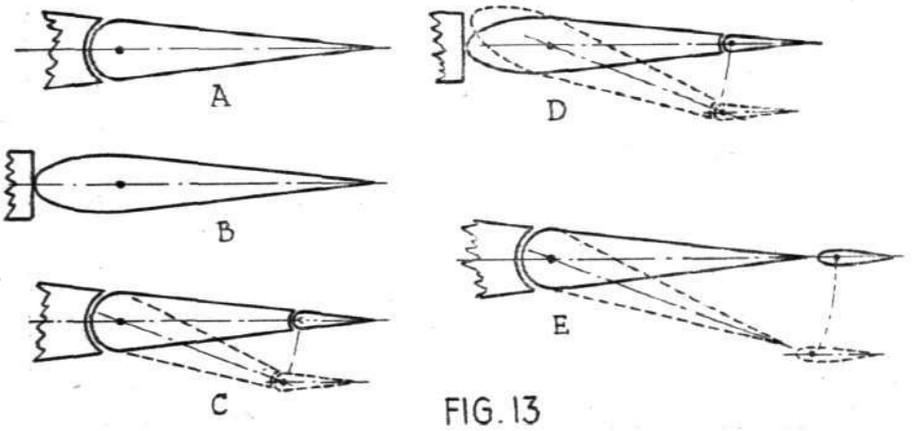




FIG. 13

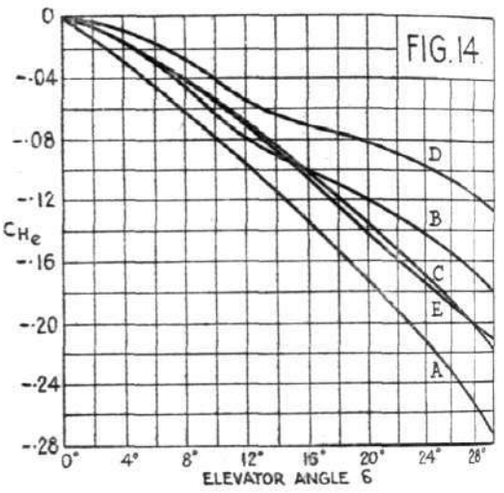



**Fig. 10, Lines of flow over stabiliser-elevator-trimming flap unit at large elevator angles. Fig. 11, Angle of trim of balanced elevator for zero stick force as affected by trimmer angle and angle of attack of stabiliser ($\alpha_s$). Elevator trimming flap configuration as in Fig. 9. Fig. 12, Elevator angle necessary to trim Curtiss-Wright "Condor" with stabiliser fixed at −0.5 deg. to wing chord, C.G. at 26.5 per cent. From wind-tunnel tests of 1/32 scale model. Fig. 13, Types of aerodynamic balances. *A*, no balance; *B*, leading edge balance (24 per cent. of overall elevator chord); *C*, inset flap balance $c_f/c_e = 0.285$, $S_f/S_e = 0.070$; *D*, leading edge balance *B* combined with flap balance *C*; *E*, external flap balance $c_f/c_e = 0.285$; $S_f/S_e = 0.070$; $AR_f = 4$. Fig. 14, Hinge moments for elevators with balances shown in Fig. 13. Stabiliser angle $\alpha_s = 0$ deg.**

from 150 m.p.h. to 130 m.p.h. agrees with the motion that was observed in flight.

In Table I, the effectiveness of the control flap diminishes rapidly at low air speeds and large flap angles. This is due to the reduced effectiveness of both the flap and the elevator as shown in Figs. 11 and 12. This has been observed in flight as well, as is illustrated in Table II, obtained in flights of a two-place Curtiss aeroplane which had both an adjustable stabiliser and an elevator control flap.

TABLE II.—*Airspeed for balance as function of stabiliser setting and flap angle.*

| *Flap angle* | *Airspeed, m.p.h.* Stab. −2°. | Stab. −6° |
|---|---|---|
| *Deg* | | |
| 0 | 137.0 | 112.0 |
| 5 | 129.0 | 105.5 |
| 10 | 122.5 | 101.0 |
| 15 | 116.5 | 99.0 |
| 20 | 112.0 | 97.5 |
| 25 | 109.0 | 97.0 |

## *Aerodynamic Balances*

In Figs. 13 and 14 are shown several types of aerodynamic balances and their comparative hinge moments. The moment curves for the flap-type balances were derived from the curves of Figs. 6 to 9 by drawing the curves through the points where $\epsilon = -\delta$. It is seen that the inset flap balance *C* has satisfactory characteristics, being somewhat better than the leading edge balance through the range of elevator angles up to 15 deg. It is in this range that aerodynamic balance is most important because, in high-speed flight when the control loads require a balance, the elevator is never moved over 15 deg.

## *Conclusions*

(1) The inset-type control surface flap is satisfactory to use as a controllable "trimmer," and its use has resulted in the simplification of the design of tail surfaces. The necessity of a stabiliser adjustment has been eliminated on aeroplanes where the elevators have been designed to have sufficient power to stall the wings. Furthermore, the use of controllable flaps on the rudders of twin-engined aeroplanes has made it possible for such aeroplanes to have satisfactory directional control in single-engine flight with single vertical tails, a marked simplification over old-type tails for twin-engined aeroplanes where a fin and rudder was placed in the slipstream of each propeller.

(2) The elevator hinge moments due to an unbalanced elevator and due to a control flap as observed in the wind tunnel were approximately 60 per cent. of the theoretical values based on thin aerofoils at small angles. The observed variation of the angle of the trim of elevator with the angle of the trimming flap was in approximate agreement, at small angles, with the theoretical variation.

(3) Wind-tunnel test of inset control flaps all with the same span but with different chord dimensions indicated that, with the elevator neutral, there was little difference in the elevator hinge moment between a flap 21 per cent. of the elevator chord and one 42 per cent. of the elevator

chord. However, at large elevator angles, the greater chord flap contributed a greater hinge moment.

(4) Comparative wind-tunnel test of inset flaps and external flaps indicated that the two types had approximately equal effectiveness even though the inset type had a smaller moment arm.

(5) The inset-type flap can be satisfactorily used as an aerodynamic balance as shown in wind-tunnel tests. The balancing effect of the flap was approximately equivalent to that of a leading edge balance up to control surface angles of 15 deg., the maximum angle to which a control surface is generally moved in high-speed flight when the balancing effect is necessary.

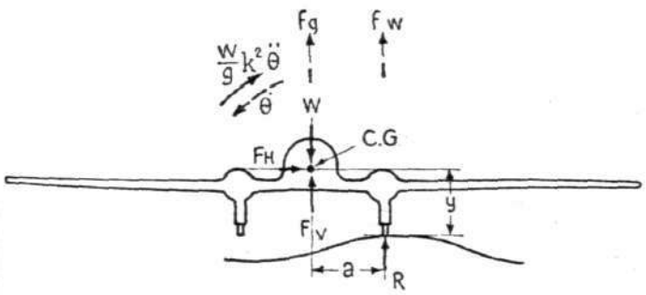
[1] W. G. A. Perring, *The Theoretical Relationships for an Aerofoil with a Multiply Hinged Flap System.* R. & M. No. 1171 (1928).
[2] George J. Higgins, *The Prediction of Airfoil Characteristics,* N.A.C.A. Report No. 312 (1929).

# ONE-WHEEL LANDINGS

## *An Investigation into the Side-load on the Undercarriage of an Aircraft Landing on One Wheel*

By B. B. WALKER, B.Sc.

WHEN an aircraft lands on one wheel (or on all the wheels on one side, if the undercarriage has more than two wheels) or when the wheel (or wheels) at one side are temporarily out of contact with the ground during taxying, a rotation commences about the point of contact with the ground. The centre of gravity must necessarily move sideways in accelerated motion, and this necessitates a force in this lateral direction; consequently, there must be a side-load on the tyre. In this investigation it is shown that this side-load is a definite proportion of the vertical-load on the wheel for any particular aeroplane (neglecting side-slip of the wheel and sideways tyre deflection) and a formula is found giving this proportion.




In what follows the simplest case is taken, in which the aircraft is trimmed laterally, but the uneven ground touches one wheel and not the other (see diagram). It will be seen that the result applies either to the condition of landing or taxying and whether the shock absorber is working, or has come to a position of equilibrium at the centre of its travel.

Let $\ddot{\theta}$ = the angular acceleration of the aircraft in radians per second per second.

$f_g$ = the vertical component of the acceleration of the centre of gravity in ft./sec.² (considered as positive upwards, *i.e.*, for retardation of fall.

$f_w$ = the vertical component of the acceleration of the parts of the machine directly above the wheel, excepting those parts which move relatively to the aircraft with the wheel (using the same sign convention).

$k$ = the radius of gyration of the aircraft in feet about a longitudinal axis through the centre of gravity.

$w$ = the weight of the aircraft in lb.

$h$ = the height in feet of the centre of gravity above the point of ground contact.

$a$ = the horizontal distance from the centre line of the machine to the point of tyre contact, in feet.

R = the vertical component of the ground reaction on the wheel, in lb.

S = the horizontal component of the ground reaction on the wheel, in lb.

The inertia forces of the machine may be divided into a vertical force Fv and a horizontal force FH, each of which is acting through the centre of gravity, and a couple C. These forces, the weight of the aircraft acting through the centre of gravity, and the ground reaction (represented by R and S), form the complete system of forces on the aircraft and are shown on the diagram.

Since the aircraft must rotate about the point of tyre contact, we have—

$$F_H = \frac{W}{g}\ddot{\theta}h \qquad (1)$$

Also, the only horizontal forces acting, FH and S, must be equal, giving—

$$S = \frac{W}{g}\ddot{\theta}h \qquad (2)$$

Equating the vertical forces gives—

$$W - F_V = R \qquad (3)$$

These equations (2) and (3) show that the horizontal forces form a couple, of magnitude $S_h$, while the vertical forces form a couple, of magnitude $R_a$ of an opposite sign. The complete system of forces, therefore, consists of these two couples and the inertia couple due to angular acceleration about the centre of gravity.

This inertia couple has a magnitude—

$\frac{W}{g}\ddot{\theta}k^2$ so that

$$\frac{W}{g}\ddot{\theta}k^2 = R_a - S_h \qquad (4)$$

By substituting the value of S from (2)

$$\frac{W}{g}\ddot{\theta}k^2 = R_a - \frac{W}{g}\ddot{\theta}h^2$$

giving—

$$\frac{W}{g}\ddot{\theta}(h^2 + k^2) = R_a \qquad (5)$$

or

$$\ddot{\theta} = \frac{Rag}{W}\,\frac{1}{h^2 + k^2} \qquad (6)$$

Substituting in (5) the value $S/h$ of

$\frac{W}{g}\ddot{\theta}$ from (2)

$$\frac{S}{h}(h^2 + k^2) = R_a$$

or

$$S = \frac{Rah}{h^2 + k^2} \qquad (7)$$

Thus the side-load on the wheel is always a definite fraction of the vertical-load for a particular machine, except for a slight variation of $h$, due to the working of the shock absorber.

In the present strength requirements of the Air Ministry for airworthiness the external force to be considered in the

case of landing on one wheel (Case 2 (i) (c) (2) in A.P. 1208, A.L. 33) is a single vertical ground reaction of 1.5 W on the one wheel making contact.

Equation (7) shows that this must actually be accompanied by a side-load of

$$1.5\ W\frac{ah}{h^2 + k^2}$$

or the total resultant ground reaction is at an angle to the vertical of which the tangent is $ah/(h^2 + k^2)$.

The nature of the coefficient shows that, given the weight of the machine and the vertical ground reaction, the side reaction is greater for a wider track, higher centre of gravity or greater concentration of masses.

A relationship is also given between the deceleration of the fall of the aircraft (or upward acceleration of the centre of gravity) $fg$, and the vertical ground reaction. Since the centre of rotation is the tyre contact point, we may substitute for $\ddot{\theta}$ the value $(f_w - f_g)/a$, given for equation (6).

$$\frac{f_w - f_g}{a} = \frac{Rag}{W}\ \frac{1}{h^2 + k^2}$$

or $$f_w - f_g = \frac{R}{W}g\ \frac{a^2}{h^2 + k^2} \quad .. \quad .. \quad .. \quad .. \quad (8)$$

Shock absorbers on aircraft by the strength requirements of the Air Ministry (Cases 2 (i) (a), etc., A.P. 1208 A.L. 33) are required to withstand an ultimate load equal to at least 2 W on each wheel, which means the limiting actual load must be about 1.75 W. If the absorber is being used for as much load in one wheel as in ordinary landing R/W in (8) is 1.75.

The difference between the acceleration at the wheel and that of the centre of gravity will, therefore, be approximately :—

$$1.75 \times 32\ \frac{a^2}{h^2 + k^2} = 56\ \frac{a^2}{h^2 + k^2}\ \frac{\text{ft.}}{\text{sec.}^2}$$

When the shock absorber has ceased working and consequently $f_w = 0$, equation (8) shows the centre of gravity to have a *downward* acceleration of

$$\frac{R}{W}g\ \frac{a^2}{h^2 + k^2}$$

It is understood that the Air Ministry has under consideration new regulations to cover the combined upward and side loads.

# TECHNICAL LITERATURE

## *Summaries of Aeronautical Research Committee Reports*

REPORTS published by His Majesty's Stationery Office, London, which may be purchased directly from H.M. Stationery Office at the following addresses: Adastral House, Kingsway, W.C.2; 120, George Street, Edinburgh; York Street, Manchester; 1, St. Andrew's Crescent, Cardiff; 15, Donegall Square West, Belfast; or through any ordinary bookseller.

INTERFERENCE BETWEEN BODIES AND AIRSCREWS. PART III. By C. N. H. Lock, M.A., and H. Bateman, B.Sc. R. & M. No. 1522. (27 pages and 3 diagrams.) August 13, 1932. Price 1s. 6d. net.

During the last few years a large amount of experimental data has been amassed on airscrew body interference, but no attempt has been made to co-ordinate the results so as to ascertain the general effect of changes of body or airscrew. By the use of the semi-empirical method developed in R. & M. 1445[6], it is possible to analyse all this data and the results are given in the present report. To obtain further evidence, chiefly with regard to the effect of excrescences, some additional experiments were made on the 3 : 1 fineness ratio body of R. & M. 1380[6], and these results are given in this report.

All results are consistent with the conclusions that the direct spoiling drag is largely a suction at the tail produced by rotation of the slipstream, and that the presence of an airscrew fairly near excrescences reduces the drag associated with their turbulent wake.

A strip theory analysis, based on the total head measurements, was made of the extreme pusher position. It was found that the power required to drive the airscrew, as calculated by strip theory, was in excellent agreement with the experimental results, thus proving that there is no appreciable direct loss of energy associated with the central sections of the airscrew blades even when these are situated in the turbulent wake of the body and annular excrescences. It should be possible with the aid of the curves deduced to calculate the performance of a screw situated in any position in the short ellipsoidal body.

[6] R. & M. 1445. Analysis of experiments on the interference between bodies and tractor and pusher airscrews.—Lock and Bateman.

[4] R. & M. 1380. Pressure and force measurements on airscrew body combinations. —Bateman and Johansen.

THE EFFECT OF A CONTRACTION ON THE TURBULENCE IN A FLUID STREAM. By A. Fage, A.R.C.Sc. R. & M. No. 1584. (8 pages and 3 diagrams.) November 21, 1932. November 24, 1933. Price 6d. net.

Experience has shown that a large contraction has a steadying influence on a turbulent fluid stream. It is for this reason that modern wind tunnels are often designed with convergent intakes. The present experiments have been undertaken to measure the changes in the disturbed velocities in both water and air streams flowing through a contraction of the same type as that used in wind tunnel design. The stream flowing into the contraction was made thoroughly turbulent by means of a grid placed in the inlet.

Measurements made on the axis showed that the maximum longitudinal velocity disturbances ($u_1$) were not greatly changed by the contraction, and that the maximum lateral velocity disturbances ($v_1$) were reduced roughly in the ratio of the outlet diameter to the inlet diameter. In other words, the values of $u_1/U$ and $v_1/U$ in the outlet were about $1/m$ and $1/m^{3/2}$ respectively of the values in the inlet, where m is the ratio of the outlet velocity to the inlet velocity, and U is the local mean velocity. This result differs from that which would be expected from a theoretical consideration of the behaviour of a single vortex passing through a contraction.

WIND TUNNEL TESTS ON—(1) FRISE AILERON WITH RAISED NOSE, (2) HARTSHORN AILERONS WITH TWISTED NOSE. By A. S. Hartshorn, B.Sc., and F. B. Bradfield, Math. and Nat. Sci. Tripos. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1587. (13 pages and 8 diagrams.) February, 1934. Price 9d. net.

The ailerons tested are an attempt to provide a closely balanced aileron which can be used to large angles and which is not sensitive to differences in rigging.

Rolling and yawing moments and hinge moments have been measured on a Frise aileron with raised nose and on two "Hartshorn" ailerons having a Frise section at the outer tip, the nose being raised progressively from the outer to the inner tip. The corresponding moments for a Frise aileron of the same overall dimensions were measured for comparison.

The modified Frise aileron with raised nose is an improvement on the Frise, giving a lighter control with less danger of overbalance. The twisted nose ailerons give a more linear hinge moment curve than the Frise with raised nose and are lighter for large aileron angles.

PRESSURE EXPLORATION OVER AN AEROFOIL THAT COMPLETELY SPANS A WIND TUNNEL. By W. L. Cowley, A.R.C.Sc., and G. A. McMillan, M.Eng. R. & M. No. 1597. (13 pages and 3 diagrams.) October, 1933. Price 9d. net.

A series of pressure explorations has been made to determine how closely the flow over an aerofoil which completely spans the wind tunnel approximates to two-dimensional flow. A 26 in. chord aerofoil of Göttingen 387 section was used. It had equal numbers of exploration tubes fitted in both upper and lower surfaces parallel to and at the same chordal distances from the leading edge.

The present tests were made in connection with the development of the design of a four-engined aircraft. A large model aerofoil was constructed for experiments on body-wing interference. The aerofoil completely spanned the Duplex tunnel and measurements of the pressure distribution were taken on the aerofoil alone. It was intended to measure the change due to adding the body. The purpose of the present report is to show that the flow over the aerofoil approximated closely to two-dimensional flow as for infinite aspect ratio.

Tests were made at a wind speed of 75 ft./sec. and angles of incidence of – 4 deg., 0 deg., 4 deg. and 8 deg. The pressures were measured on the aerofoil when the ends were 6 in. from the walls, and when the gaps between the ends and the walls were filled in with end pieces of the same aerofoil section.

## *Speed and Drag*

A few misprints occurred in last month's article on "The Speed and Drag of Commercial Aeroplanes," by Mr. W. O. Manning. Most readers will probably have realised the mistakes, but for the benefit of those who wish to correct their copies, the amendments are as follow: Near the bottom of the right-hand column of p. 4 the sentence "R is obviously = D," etc., for D substitute O, and again further on "as then L = O" (not D). Again, from the line beginning "Differentiating," etc., $d$ should be substituted everywhere for $\alpha$, the third and second lines from the bottom then reading "when $\frac{dR}{dL} = 0$, so $KW - 2Kx L = O$." Finally, the last equation, on p. 5, should read $R = K\frac{W^2}{4x}$

case of landing on one wheel (Case 2 (i) (c) (2) in A.P. 1208, A.L. 33) is a single vertical ground reaction of 1.5 W on the one wheel making contact.

Equation (7) shows that this must actually be accompanied by a side-load of

$$1.5\ W\frac{ah}{h^2 + k^2}$$

or the total resultant ground reaction is at an angle to the vertical of which the tangent is $ah/(h^2 + k^2)$.

The nature of the coefficient shows that, given the weight of the machine and the vertical ground reaction, the side reaction is greater for a wider track, higher centre of gravity or greater concentration of masses.

A relationship is also given between the deceleration of the fall of the aircraft (or upward acceleration of the centre of gravity) $fg$, and the vertical ground reaction. Since the centre of rotation is the tyre contact point, we may substitute for $\ddot{\theta}$ the value $(f_w - f_g)/a$, given for equation (6).

$$\frac{f_w - f_g}{a} = \frac{Rag}{W}\frac{1}{h^2 + k^2}$$

or $$f_w - f_g = \frac{R}{W}g\cdot\frac{a^2}{h^2 + k^2} \quad .. \quad .. \quad .. \quad .. \quad (8)$$

Shock absorbers on aircraft by the strength requirements of the Air Ministry (Cases 2 (i) (a), etc., A.P. 1208 A.L. 33) are required to withstand an ultimate load equal to at least 2 W on each wheel, which means the limiting actual load must be about 1.75 W. If the absorber is being used for as much load in one wheel as in ordinary landing R/W in (8) is 1.75.

The difference between the acceleration at the wheel and that of the centre of gravity will, therefore, be approximately :—

$$1.75 \times 32\frac{a^2}{h^2 + k^2} = 56\frac{a^2}{h^2 + k^2}\ \frac{\text{ft.}}{\text{sec.}^2}$$

When the shock absorber has ceased working and consequently $f_w = 0$, equation (8) shows the centre of gravity to have a *downward* acceleration of

$$\frac{R}{W}g\frac{a^2}{h^2 + k^2}$$

It is understood that the Air Ministry has under consideration new regulations to cover the combined upward and side loads.

# TECHNICAL LITERATURE

## *Summaries of Aeronautical Research Committee Reports*

REPORTS published by His Majesty's Stationery Office, London, which may be purchased directly from H.M. Stationery Office at the following addresses: Adastral House, Kingsway, W.C.2; 120, George Street, Edinburgh; York Street, Manchester; 1, St. Andrew's Crescent, Cardiff; 15, Donegall Square West, Belfast; or through any ordinary bookseller.

INTERFERENCE BETWEEN BODIES AND AIRSCREWS. PART III. By C. N. H. Lock, M.A., and H. Bateman, B.Sc. R. & M. No. 1522. (27 pages and 3 diagrams.) August 13, 1932. Price 1s. 6d. net.

During the last few years a large amount of experimental data has been amassed on airscrew body interference, but no attempt has been made to co-ordinate the results so as to ascertain the general effect of changes of body or airscrew. By the use of the semi-empirical method developed in R. & M. 1445[6], it is possible to analyse all this data and the results are given in the present report. To obtain further evidence, chiefly with regard to the effect of excrescences, some additional experiments were made on the 3 : 1 fineness ratio body of R. & M. 1380[7], and these results are given in this report.

All results are consistent with the conclusions that the direct spoiling drag is largely a suction at the tail produced by rotation of the slipstream, and that the presence of an airscrew fairly near excrescences reduces the drag associated with their turbulent wake.

A strip theory analysis, based on the total head measurements, was made of the extreme pusher position. It was found that the power required to drive the airscrew, as calculated by strip theory, was in excellent agreement with the experimental results, thus proving that there is no appreciable direct loss of energy associated with the central sections of the airscrew blades even when these are situated in the turbulent wake of the body and annular excrescences. It should be possible with the aid of the curves deduced to calculate the performance of a screw situated in any position in the short ellipsoidal body.

[6] R. & M. 1445. Analysis of experiments on the interference between bodies and tractor and pusher airscrews.—Lock and Bateman.

[7] R. & M. 1380. Pressure and force measurements on airscrew body combinations. —Bateman and Johansen.

THE EFFECT OF A CONTRACTION ON THE TURBULENCE IN A FLUID STREAM. By A. Fage, A.R.C.Sc. R. & M. No. 1584. (8 pages and 3 diagrams.) November 21, 1932. November 24, 1933. Price 6d. net.

Experience has shown that a large contraction has a steadying influence on a turbulent fluid stream. It is for this reason that modern wind tunnels are often designed with convergent intakes. The present experiments have been undertaken to measure the changes in the disturbed velocities in both water and air streams flowing through a contraction of the same type as that used in wind tunnel design. The stream flowing into the contraction was made thoroughly turbulent by means of a grid placed in the inlet.

Measurements made on the axis showed that the maximum longitudinal velocity disturbances ($u_1$) were not greatly changed by the contraction, and that the maximum lateral velocity disturbances ($v_1$) were reduced roughly in the ratio of the outlet diameter to the inlet diameter. In other words, the values of $u_1/U$ and $v_1/U$ in the outlet were about $1/m$ and $1/m^2$ respectively of the values in the inlet, where m is the ratio of the outlet velocity to the inlet velocity, and U is the local mean velocity. This result differs from that which would be expected from a theoretical consideration of the behaviour of a single vortex passing through a contraction.

WIND TUNNEL TESTS ON—(1) FRISE AILERON WITH RAISED NOSE, (2) HARTSHORN AILERONS WITH TWISTED NOSE. By A. S. Hartshorn, B.Sc., and F. B. Bradfield, Math. and Nat. Sci. Triposes. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1587. (13 pages and 8 diagrams.) February, 1934. Price 9d. net.

The ailerons tested are an attempt to provide a closely balanced aileron which can be used to large angles and which is not sensitive to differences in rigging.

Rolling and yawing moments and hinge moments have been measured on a Frise aileron with raised nose and on two "Hartshorn" ailerons having a Frise section at the outer tip, the nose being raised progressively from the outer to the inner tip. The corresponding moments for a Frise aileron of the same overall dimensions were measured for comparison.

The modified Frise aileron with raised nose is an improvement on the Frise, giving a lighter control with less danger of overbalance. The twisted nose ailerons give a more linear hinge moment curve than the Frise with raised nose and are lighter for large aileron angles.

PRESSURE EXPLORATION OVER AN AEROFOIL THAT COMPLETELY SPANS A WIND TUNNEL. By W. L. Cowley, A.R.C.Sc., and G. A. McMillan, M.Eng. R. & M. No. 1597. (13 pages and 3 diagrams.) October, 1933. Price 9d. net.

A series of pressure explorations has been made to determine how closely the flow over an aerofoil which completely spans the wind tunnel approximates to two-dimensional flow. A 26 in. chord aerofoil of Göttingen 387 section was used. It had equal numbers of exploration tubes fitted in both upper and lower surfaces parallel to and at the same chordal distances from the leading edge.

The present tests were made in connection with the development of the design of a four-engined aircraft. A large model aerofoil was constructed for experiments on body-wing interference. The aerofoil completely spanned the Duplex tunnel and measurements of the pressure distribution were taken on the aerofoil alone. It was intended to measure the change due to adding the body. The purpose of the present report is to show that the flow over the aerofoil approximated closely to two-dimensional flow as for infinite aspect ratio.

Tests were made at a wind speed of 75 ft./sec. and angles of incidence of − 4 deg., 0 deg., 4 deg. and 8 deg. The pressures were measured on the aerofoil when the ends were 6 in. from the walls, and when the gaps between the ends and the walls were filled in with end pieces of the same aerofoil section.

## *Speed and Drag*

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# THE ROYAL AIR FORCE

SERVICE NOTES AND NEWS — AIR MINISTRY ANNOUNCEMENTS

## ROYAL AIR FORCE DISPLAY, 1935

The sixteenth annual Royal Air Force Display will be held at the Royal Air Force Station, Hendon, on Saturday, June 29, 1935.

## CAMBRIDGE UNIVERSITY AIR SQUADRON

The Annual Dinner of the Cambridge University Air Squadron will be held on Friday, March 8th, 1935, at the University Arms Hotel, Cambridge, at 7.45 p.m. for 8 o'clock. Any past Instructors or past Members who wish to attend should communicate with the Secretary, C.U. Air Squadron, Fen Causeway, Cambridge, before February 22nd. The cost of the dinner, including wines, is 15s.

## SELECTION OF AIRMEN AS PILOTS

The limits which have hitherto been imposed on the numbers of airmen who may be recommended by each command for training as pilots are withdrawn and A.Os.C. may in future recommend any number of airmen who are suitable and who comply with the specified conditions of eligibility.

## NO. 101 (BOMBER) SQUADRON

The new Boulton and Paul "Overstrand" is to be allocated to No. 101 (Bomber) Squadron at Bicester in replacement of the "Sidestrand." This is a natural move, as the Squadron is already accustomed to the class of twin-engined medium bombers. The new type has two Bristol "Pegasus" engines, whereas the "Sidestrand" has "Jupiters." The "Overstrand" has a mechanically operated and enclosed gun turret in the nose of the machine, which protects the gunner from the air pressure and so should make for more accurate shooting. It also gives an extremely wide range of fire. The medium bomber class of machines can be used either for day or night work, and so well are they armed and so manœuvrable are they that it is the practice to send them out singly.

## A "DRAGON RAPIDE" FOR THE R.A.F.

The Air Ministry has placed an order with the De Havilland firm for a "Dragon Rapide" (two "Gipsy six") to be used for communications.

# ROYAL AIR FORCE GAZETTE

*London Gazette, February 19, 1935*

*General Duties Branch*

P. E. Hadow is granted a permanent commission as a Pilot Officer with effect from Feb. 1.

The following Flying Officers are promoted to the rank of Flight Lieutenant (Jan. 27):—J. A. Powell, R. L. Phillips, E. R. Simonds, R. E. de T. Vintras, M. L. Heath, W. S. Hebden, W. V. L. Spendlove, I. B. Newbigging, F. W. Stannard, H. R. L. Hood, A. O. Molesworth, R. C. Mead.

*Stores Branch*

F/O. R. W. Wallace is granted a permanent commission in this rank with effect from Jan. 4, 1934, on completion of probationary service. F/O. C. H. W. Boldero is promoted to the rank of Flight Lieutenant (Jan. 10).

*Medical Branch*

F/O. I. Mackay, M.B., Ch.B., D.P.H., is promoted to the rank of Flight Lieutenant, with effect from Jan. 8 and with seny. of May 1, 1934.

## ROYAL AIR FORCE RESERVE

*Reserve of Air Force Officers*

*General Duties Branch*

H. D. Raynham is granted a commission as Flying Officer in class A (Jan. 19).

The following Pilot Officers on probation are confirmed in rank:—R. T. Needham (Nov. 15, 1934); L. G. O. Hutchison, H. P. McClean (Nov. 29, 1934); P. J. Field-Richards (Dec. 9, 1934); G. F. Hall (Jan. 4); W. Hill (Jan. 9); T. E. Wesson (Jan. 22).

F/O. C. E. F. Arthur is transferred from class A to class C (Feb. 15). F/O. A. P. Wayte is transferred from class C to class A (Aug. 5, 1934). F/O. L. A. Hackett relinquishes his commission on appointment to a commission in the Auxiliary Air Force Reserve of Officers (Jan. 15). P/O. on probation P. E. Hadow relinquishes his commission on appointment to a permanent commission in the R.A.F. (Feb. 1). F/O. D. L. Maclean is removed from the Service (Feb. 6). The notification in the *Gazette* of Oct. 23, 1934, concerning Flt. Lt. H. B. Collins is cancelled. The notification in the *Gazette* of Aug. 21, 1934, concerning F/O. A. P. Wayte is cancelled.

## SPECIAL RESERVE

*General Duties Branch*

P/O. H. Baker is promoted to the rank of Flying Officer (Dec. 1, 1934).

## AUXILIARY AIR FORCE RESERVE OF OFFICERS

*General Duties Branch*

L. A. Hackett is granted a commission as Flying Officer in class A (Jan. 15).

## TERRITORIAL ARMY

ROYAL ENGINEERS

*Anti-Aircraft Searchlight Battalions*

26TH (LOND.) A.A.S. BN. (L.E.E.).—Sec. Lt. H. T. Cadbury-Brown to be Lieutenant (Feb. 20).

*Anti-Aircraft Searchlight Companies*

KENT AND MIDD'X GROUP.—Sec. Lt. H. C. Bagnall to be Lieutenant (Nov. 13, 1934).

# ROYAL AIR FORCE INTELLIGENCE

**Appointments.**—The following appointments in the Royal Air Force are notified:—

*General Duties Branch*

*Wing Commanders.*—H. G. Bowen, M.B.E., to Headquarters, R.A.F., Middle East, Cairo, 30.1.35; for duty as Senior Personnel Staff Officer vice Wing Cdr. H. M. Probyn, D.S.O. E. G. Hopcraft, D.S.C., to Headquarters, Western Area, Andover, 11.2.35; for duty as Senior Personnel Staff Officer vice Group Capt. G. B. Dacre, D.S.O. R. B. Mansell, O.B.E., to Station Headquarters, Tangmere, 11.2.35; to command vice Wing Cdr. E. G. Hopcraft, D.S.C.

*Squadron Leaders.*—F. L. B. Hebbert, to Headquarters, R.A.F., Iraq, Hinaidi, 30.1.35; for Air Staff Intelligence duties vice Sqn. Ldr. A. D. Macdonald, M.C. W. E. Staton, M.C., D.F.C., to Headquarters, Inland Area, Stanmore, 15.2.35; for Personnel Staff duties vice Sqn. Ldr. C. B. S. Spackman, D.F.C.

*Flight Lieutenants.*—C. E. N. Guest, to No. 8 (B) Squadron, Aden, 9.2.35. R. O. Jones, to No. 39 (B) Squadron, Risalpur, India, 9.2.35. R. Reay-Jones, to No. 1 (Indian) Group Headquarters, Peshawar, India, 9.2.35. F. R. D. Swain, to Experimental Section, Royal Aircraft Establishment, S. Farnborough, 15.2.35.

*Flying Officers.*—P. R. Robinson, to No. 822 (F.S.R.) Squadron, Manston, 7.1.35. S. P. A. Patmore, to No. 39 (B) Squadron, Risalpur, India, 20.1.35.

*Pilot Officers.*—P. W. Bale, to Station Headquarters, Hal Far, Malta, 4.2.35. H. S. Darley, to No. 8 (B) Squadron, Aden, 9.2.35. P. J. A. Riddell, to No. 28 (Army Co-operation) Squadron, Ambala, India, 9.2.35.

*Stores Branch*

*Flight Lieutenant.*—R. T. Rich, to Headquarters, R.A.F., Aden, 9.2.35.

*Flying Officers.*—W. G. R. Jarman, to No. 1 (Indian Wing) Station, Kohat, India, 9.2.35. A. Selby, to Aircraft Park, India, Lahore, 9.2.35. D. Stephenson, to Stores & Supplies Depot, Aden, 9.2.35.

*Accountant Branch*

*Flight Lieutenant.*—J. M. Murray, to No. 3 Flying Training School, Grantham, 15.2.35.

*Medical Branch*

*Wing Commander.*—A. E. Barr-Sim, to No. 1 Air Defence Group Headquarters, 25.2.35; for duty as Principal Medical Officer vice Wing Cdr. R. S. Overton.

*Squadron Leaders.*—E. N. H. Gray, to Station Headquarters, Bircham Newton, 11.2.35; for duty as Medical Officer. A. Harvey, to Central Medical Establishment, 13.2.35; for duty as Medical Officer.

*Flight Lieutenants.*—E. Donovan, to R.A.F. Hospital, Aden, 9.2.35. A. L. St. A. McClosky, to Station Headquarters, North Weald, 15.2.35.

*Flying Officer.*—W. P. Stamm, to R.A.F. Hospital, Aden, 9.2.35.

# HERE and THERE

200M.P.H. TRAINERS: The widespread adoption of high-speed monoplanes in the U.S.A. has, it would appear, necessitated the provision of special training equipment. Accordingly, the U.S. Army Air Corps has ordered 35 SEV-3XAR monoplanes of the type shown here. Fitted with a 400 h.p. Wright "Whirlwind," the machine has a maximum speed of 200m.p.h. and the climb to 12,000 ft. occupies ten minutes.

## At St. James's Palace

His Majesty the King held a levée on February 22 at St. James's Palace, when the following were amongst those present:—Air Chief Marshal Sir Robert Brooke-Popham, A.D.C., Group Capt. T. E. B. Howe, Wing Cdr. Sir Louis Greig, and Lord Londonderry, Secretary of State for Air. Amongst those presented to His Majesty were: Gen. Putna, Military and Air Attaché, Soviet Union; F/O. Ivor Bird; Sqn. Ldr John Breckey, D.F.C.; Sqn. Ldr. Raymond Brownell, M.C., M.M., R.A.A.F.; Flt. Lt. Wilfred Burke; F/O. Donald Cameron; F/O John Cherry, A.A.F.; Air Vice-Marshal Christopher Courtney, C.B., C.B.E., D.S.O.; Sqn. Ldr. George Daly, D.F.C.; Wing Cdr. Wilfred Dunn, D.S.C.; Sqn. Ldr. Robert Foster, D.F.C.; Flt. Lt. Harold Gilbert; Group Capt. Andrew Grant, M.B.E., M.B., Ch.B., D.P.H.; Flt. Lt S. W. Hill, Flt. Lt. Leonard Horwood, M.C., F/O. A. H. Houghton, Flt. Lt. Humphrey Humphreys, L.D.S., Flt. Lt. Richard Keary, Group Capt. R. B. Maycock, O.B.E., Wing Cdr. Athol Mylne, Air Vice-Marshal C. L. N. Newall, C.B., C.M.G., Sqn. Ldr. J. T. Paine, Flt. Lt. M. G. Philpott, Flt. Lt. O. R. Pigott, Flt. Lt. J. A. Powell, Flt. Lt. H. J. G. Proud, Sqn. Ldr. A. A. Townsend, M.B., B.Ch., Sqn. Ldr. R. W. White, M.R.C.S., L.R.C.P., Sqn. Ldr. C. G. Wigglesworth, A.F.C., Flt. Lt J. V. Wood, A.A.F., Sqn. Ldr. F. R. Wynne, M.B.E.

## Another Barrier Down

The A.A. has been informed that, in view of the fact that the Spanish Government has adhered to the International Air Convention, no further permits will be required for British pilots flying over Spain.

In the past permits for Spain have not been obtainable in less than a week from the time of application, and, consequently, urgent flights there have been impossible.

The Aviation Section of the London Chamber of Commerce, with the active co-operation of the A.A. and the R.Ae.C., has long been urging upon the Government the necessity for international action to remove the many "barriers to aircraft," and the Government announced recently that the question would be brought up for consideration at the next I.C.A. meeting.

## Lord Sempill's Flight

On two occasions since leaving Melbourne Lord Sempill has found it necessary to land between stages, and some sections of the Press have cited his extreme experience as indicating the unreliability of aircraft for world-wide travel.

On a flight involving nearly 30,000 miles, it is not surprising that a pilot of a light aeroplane should occasionally land in an uncharted spot.

The first forced landing referred to occurred at South Roebourne, on the West Coast of Australia, near Port Hedland, where Lord Sempill ran into a sudden storm and landed on a sheltered beach, continuing the next morning.

On the second occasion he landed near Tandjong Merak, between Rambang and Sourabaya, through shortage of petrol. He made his way through the jungle and struck a highway, where a passing motorist gave him a lift to the next township. Here he obtained sufficient petrol to enable him to continue.

## The South Atlantic "Comet"

After waiting for good weather reports, the Portuguese airmen, Lt. Carlos Macedo and Mr. Carlos Bleck, left Hatfield for Lisbon in their "Comet," *Salazar*, on Tuesday morning at 10.20 a.m.

As soon as possible, *Salazar* is to be flown across the South Atlantic to convey greetings to the thousands of Portuguese who live in Latin America and to demonstrate the advantages of Lisbon as a European terminus for Atlantic flights.

Macedo and Bleck propose to fly the 1,925 miles by day to the Cape Verde Islands, where Air France have a very large, and more or less natural, aerodrome which is used by the mail machines, and to leave there at midnight for Natal. This stage is 1,860 miles long. Thereafter the "Comet" will be flown down the Brazilian coast for 1,428 miles to Rio de Janeiro and the pilots expect to cover the whole distance in less than forty-eight hours.

The pilots say that they will not fly at the "Comet's" best operating height during the crossing, owing to the strong adverse trade winds to be found at 15,000ft., but will fly at a reduced air speed with favourable winds at a lower altitude.

*Salazar*, of course, was originally *Black Magic*, the "Comet" with which Mr. and Mrs. Mollison flew in record time from Mildenhall to Baghdad and Karachi during the Australia race in October. The machine has been purchased by the Portuguese Government.

## Expansion at Filton

To anyone who has watched air developments closely during the last few months it has been obvious that Bristol aero engines are used in increasing numbers both at home and abroad. During the last months of 1934 the Bristol engine shops were working night shifts, but even this failed to cope with the demand. To increase output by slightly lowering the standards of workmanship and finish has never been the Bristol way, and when the demand for engines continued to increase there was no other way of meeting it than to build engine works extensions.

This has now been done, and the new building has given an increased floor space of 28,000 sq. ft., which means, approximately, a 25 per cent. increase in machining capacity. By transferring certain equipment from existing buildings to others used for different purposes, the equivalent of still greater floor space has been provided, combined with a more convenient location, so that from now onwards purchasers of Bristol aero engines may expect a considerable speeding-up of deliveries.

## Recent Appointments

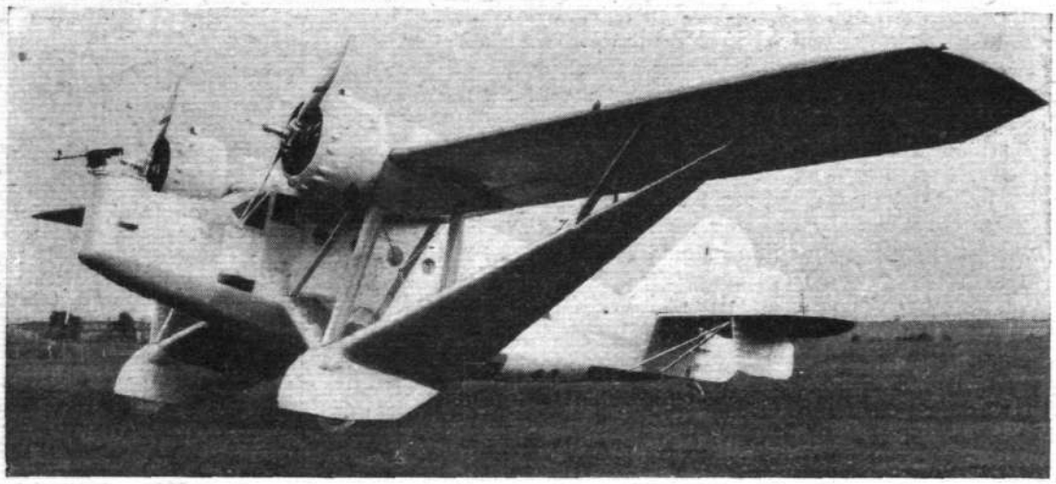
Recent technical appointments of interest in the aviation industry include those of Mr. Frank Radcliffe as chief designer of Airspeed, Ltd., at Portsmouth, and Mr. H. A. Mettam to A. V. Roe & Co., Ltd., of Manchester, for design and stress work in connection with Autogiros.

Mr. D. C. Adkins, who has been editor of *Shell Aviation News* since the inception of that excellent publication, is taking up a position on the sales staff of the De Havilland Aircraft Co., Ltd. His place will be taken by Mr. R. Snodgrass, who has had considerable experience with *Shell Aviation News*.

*FOREIGN AIRCRAFT*

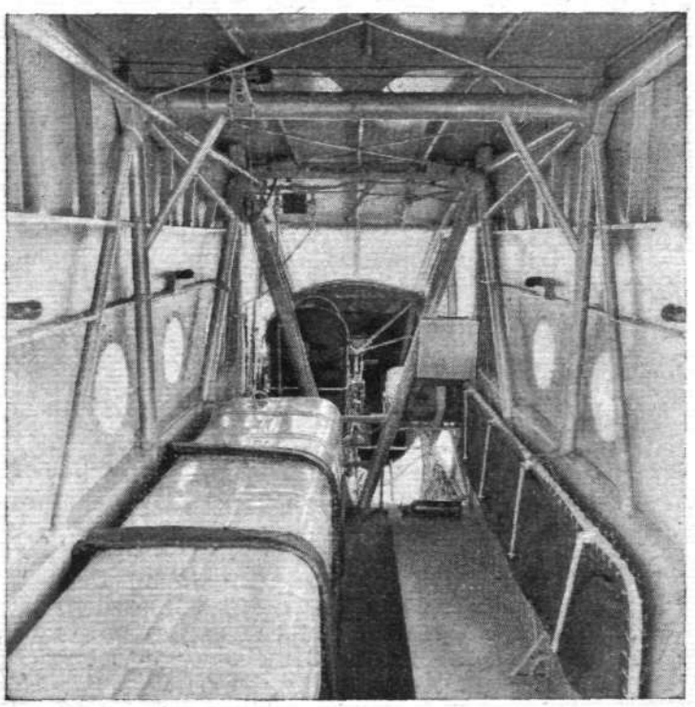
# AMERICAN ADAPTABILITY

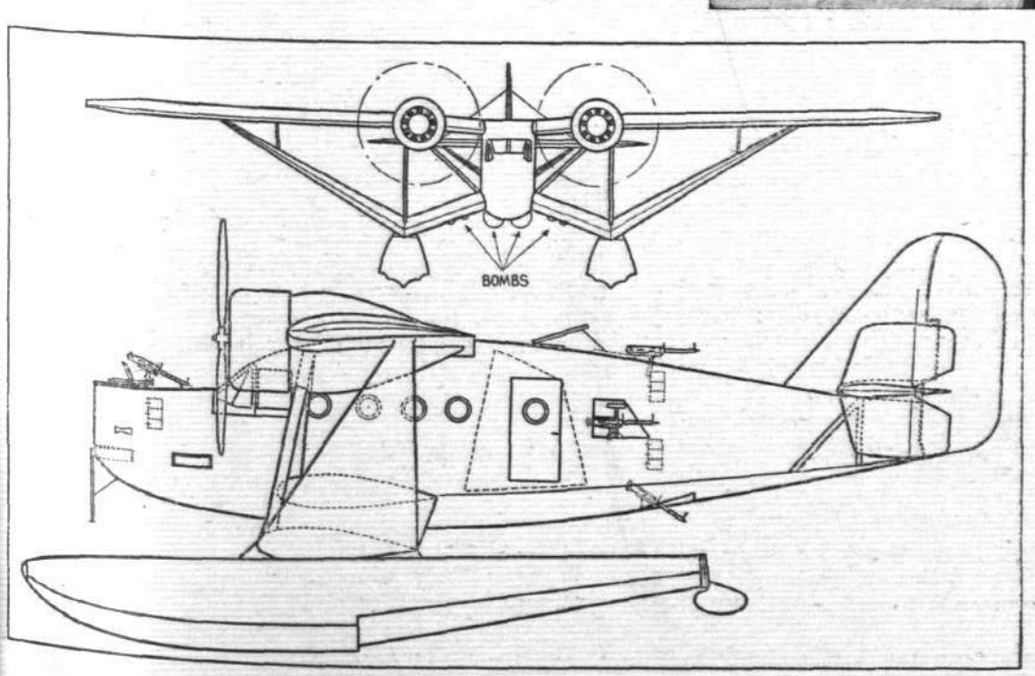
*A 190 m.p.h. Bellanca Bomber Adaptable for Several Purposes: Landplane or Seaplane*



LARGER than any previous model produced by this well-known American firm, the new Bellanca bomber retains numerous distinctive "family" features. It is apparent that the experience gained with the "Airbus" and "Aircruiser" types has been applied to the design, which embodies a high wing with bracing struts forming auxiliary aerofoils, their inner portions, from the undercarriage attachment to the fuselage, being placed at a pronounced anhedral angle. Four of the new machines, which may be operated as landplanes or on floats, have been built for the Colombian Government and on their delivery flight may attempt to break distance records for seaplanes. An eighteen-passenger civil version, the most attractive feature of which is its 6,210lb. disposable load, will soon be put on the market.

The folding fabric-covered wings are of wooden two-spar construction, with closely spaced plywood ribs. Both the "auxiliary" wings and the lower stub wings are of welded steel tubes with fabric covering, and the inner portions of the main planes are covered with aluminium alloy. Chrome molybdenum steel tubing is employed for the fabric-covered fuselage. In the nose there is a gunner's position, and aft of this is the pilot's cockpit with dual controls. An anchor winch is one of the numerous items provided. A position for the bomb aimer is incorporated to the side of,






*(Top)*

There is a very distinct resemblance shown by the Bellanca bomber to some of the commercial "heavy-weights" produced by the company.

*(Centre)*

Stressed-skin monocoques have not put the fabric-covered welded structure entirely "out of business." Note, in this view of the Bellanca's cabin, the long-range tank strapped to the floor.

*(Bottom)*

Bombs are carried partially buried in the lower wing "stubs" and in the fuselage. The great depth of the fuselage and the disposition of the guns are noteworthy.

and just below, the pilot's compartment and is well provided with Pyralin windows. There are two gunner's positions behind the wings.

The cabin is 13ft. long and 6ft. high, and is adaptable to several purposes. Six stretchers may be installed or provision may be made for carrying eighteen soldiers, cargo, spare engines, or bombs. Behind the cabin is a 180-gallon abdominal tank, which, in combination with a removable 200-gallon tank strapped to the cabin floor, and the 300 gallons normally carried in tanks in the upper stub wings and engine nacelles, gives a 1,500-mile range in "maximum overload" condition.

The design and arrangement of the tail surfaces, which are of wood or welded steel tubular construction, is such as to provide easy operation on a single engine without manœuvring the machine into awkward positions to maintain flight.

Two direct-drive supercharged Wright "Cyclone F-3" nine-cylinder radials giving 710 h.p. at 7,000 feet are installed in N.A.C.A. cowlings and are attached to rubber-bushed chrome molybdenum mountings on the top wings.

Exceptional aerodynamic efficiency is a feature of the seaplane version, for the floats, which are of all-metal riveted aluminium alloy construction with retractile water rudders and beaching gear attachments, are simply and neatly attached to the same points as are the wheels of the landplane. Even as a seaplane the machine will fly on one engine with full load, maintaining a height of 8,000 feet.

**BELLANCA BOMBER LANDPLANE**

TWO WRIGHT "CYCLONE F-3" (710 H.P. AT 7,000 FT.)

| | |
|---|---|
| **DIMENSIONS.** | |
| Span | 76ft. (*23,16 m*) |
| Length | 40ft. (*12,19 m*) |
| Height | 14ft. (*4,26 m*) |
| **WEIGHTS.** | |
| Weight empty | 8,216lb. (*3 726 kg*) |
| Normal weight loaded | 14,136lb. (*6 411 kg*) |
| Maximum weight loaded | 16,333lb. (*7 407 kg*) |
| **PERFORMANCE.** | |
| Maximum speed at 7,000ft. | 190 m.p.h. |
| Cruising speed (75 per cent. full power) | 172 m.p.h. |
| Stalling speed (with flaps) | 58 m.p.h. (*93,3 km/h*) |
| Climb to 6,560 ft. (*2,000 m*) | 5.5 min. |
| Climb to 16,400ft. (*5,000 m*) | 17.7 min. |
| Absolute ceiling | 25,000ft. (*7 620 m*) |
| Normal range | 710 miles (*1 143 km*) |
| Maximum range | 1,500 miles (*2 414 km*) |

# FOR "PURSUIT" WORK

## *The Consolidated P-30 Monoplane, adopted by the U.S. Army Air Corps*

WITHOUT taking sides in any monoplane *v.* biplane argument, the very least one can do in writing of America's widespread adoption of monoplanes for fighting purposes is to regret that Professor Aldous Huxley has already thought of the title "Brave New World."

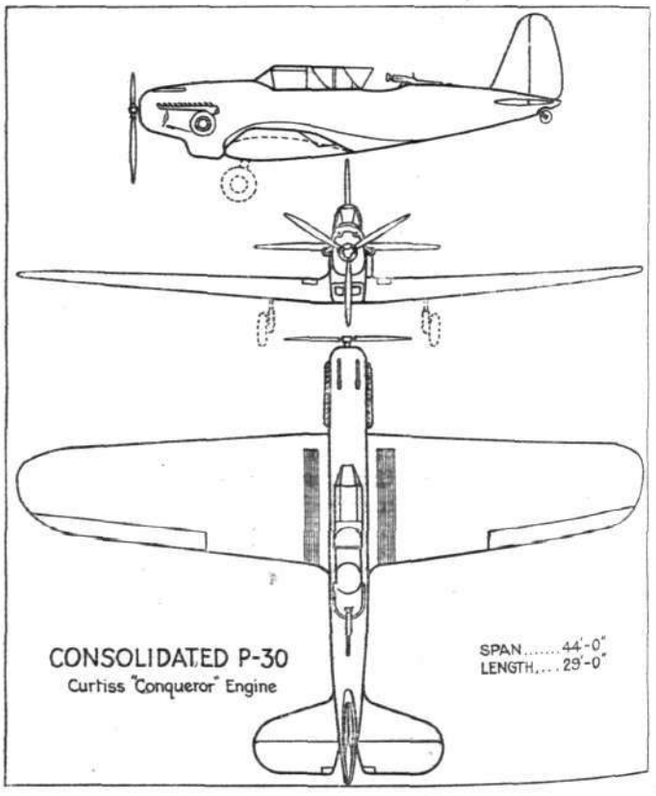
It was a bold step to adopt a single-seater fighter of the pattern of the Boeing P-26A and to issue it as a standard service type. Not that there are any doubts regarding the qualities of that aeroplane, but the change was a radical one. The hundred odd P-26A's acquired have been in everyday service for several months past, and, as far as we know, the U.S. Army Air Corps has not regretted its action. Its hand was forced, of course. It was the well-known story of new and cleverly designed bombers "walking" away from fighters, and so the handy little biplanes had to make way for the superior speed given by monoplanes like the P-26A. That was a year or two ago.

Now comes news that the Consolidated P-30 cantilever monoplane has been adopted as the standard two-seater "pursuit" type. What engine will be used is not definitely known.

The Consolidated machine has been developed from the P-25, and was illustrated in *Flight* of December 20, 1934. Four P-30's have for some time been under service tests in the hands of American service pilots. No particulars of construction or performance have been divulged from official quarters, but it appears that the machine is entirely of metal with stressed-skin-covered monocoque fuselage and cantilever wing. The tail surfaces are of full cantilever construction. In the prototype a Curtiss "Conqueror" twelve-cylinder vee-type liquid-cooled engine is fitted, with an exhaust-drive supercharger mounted on its port side; it drives a three-bladed metal airscrew. The radiator is of the abdominal type.

A very neat system of cockpit protection is incorporated, the roof of the pilot's compartment, which is situated above the wing, being arranged to slide, permitting exit by parachute. Two Browning guns are mounted in the cowling. In the rear gunner's cockpit, close behind that of the pilot, is a third Browning gun on a track-type mounting. This gun, when not in use, lies in a trough in the fuselage decking. The two halves of the retractile undercarriage fold upwards into the wing.

Similar in basic design to the P-30, the A-11 "attack" machine, under test at the moment, has an unsupercharged "Conqueror" engine giving the high performance at low altitudes required by an "attack" machine, and special armament and equipment.




### *Two-row Engines Favoured in U.S.A.*

It is probable that the new Northrop attack monoplanes ordered by the U.S. Army Air Corps will be fitted with two-row Pratt and Whitney radials of 700 or 800 h.p. New Vought scouting biplanes ordered by the U.S. Navy will have 700 h.p. "Twin Wasp Juniors," with special cowlings allowing for "controlled cooling."

# PRIVATE FLYING

# Arrival in Australia

**LORD SEMPILL CONTINUES THE STORY OF HIS AUSTRALIA FLIGHT : THROUGH THE NETHERLANDS INDIES AND ACROSS THE TIMOR SEA**

AFTER leaving Singapore for Batavia my journey through the Dutch East Indies was uneventful. It was at the same time a very pleasant experience for the reputation of the Dutch Colonies for tropical beauty is not unmerited. To Batavia I followed the route now taken by the K.L.M. air liners, down the Coast of Sumatra *via* Palembang, arriving at the capital after 7½ hours' flying. Just before reaching Batavia one passes over the Sunda Strait, to the South of which lies the famous submarine volcano, Krakatau.

The aerodrome at Batavia is a military one, but is available for civil use and lies about seven miles to the south-east of the town. It has a flat grass surface with good hangarage and is very efficiently run. There are also wireless facilities. About sixty miles to the south-east is Bandoeng, a charming holiday resort in the Preanger Mountains, lying some 2,300 feet above sea level. The Dutch East Indies are well equipped with hill stations, where the climatic conditions are very pleasant, and Bandoeng, with its excellent aerodrome and facilities, is one of the most accessible health centres.

## *The Progressive Dutch*

THE Koninklijke Nederlandsch Indische Luchtvaart Maatschappij (Royal Netherlands Indian Airways)—mercifully abbreviated to K.N.I.L.M.—run a service twice daily in each direction from Bandoeng to Batavia. I should have liked to visit this town, as the route not only passes over some beautiful country, but there are many famous beauty spots in the vicinity. The Dutch are rightly very proud of their colonial possessions, the Netherlands Indies, and essential services, particularly transport, have been highly organised. Surface transport, whether sea, rail, or road, is very well run. There is an extensive network of State railways in Sumatra and Java, as well as lines operated by private companies. The service compares favourably with the best European lines. In all the larger islands really good motor highways have been constructed, supplemented by thousands of miles of second-class roads. The lengthy chain of islands which comprise the Dutch East Indies naturally lends itself to the development of air transport, and the K.N.I.L.M. has already organised a fine system of routes stretching from Sourabaya in Java to Medan in the north of Sumatra. Flying conditions generally in Netherlands India are excellent. There is no fog, and, while rainstorms sometimes occur, they are usually of a local character.

## Cooler Transport

FROM the inauguration of their first service at the end of 1928 the operations of the K.N.I.L.M. have been very successful. Regularity on practically all routes is 100 per cent. Fokker machines of the Fviib and Fxii types are used. The latter are equipped with three "Wasp" engines and carry sixteen passengers. These high-wing monoplanes are particularly suitable for tropical flying, as the wing protects the cabins and passengers from the rays of the sun. The advantages of air transport in these equatorial regions are becoming more and more appreciated. At two to three thousand feet the temperature is reduced to about 65° F., which makes flying, as contrasted with surface travel, very pleasant.

Apart from the four main airports, there are three auxiliary aerodromes and over thirty landing grounds in Java itself. A great deal could be written of the wonderful development of commercial life in the Dutch East Indies, but we must resume our journey.

Having been very kindly entertained by the British Consul-General at Batavia, I left next day for Sourabaya, which was reached without incident. From Sourabaya I had occasion to put in a telephone call to London, and the promptness with which I was connected and the remarkable clarity of the line made one feel how greatly the long-distance telephone system had been developed within the last few years.

The aerodrome at Sourabaya is very well organised, being the Eastern terminus of the K.N.I.L.M. system. The landing area consists of two runways, measuring respectively 760 × 320 yards and 650 × 320 yards, and there is good hangarage.

On the following morning I left early on the last stage to Timor and reached Rambang, on the Island of Lombock, after 3 hr. 15 min. flying. The aerodrome here has a good, dry, sandy surface, but slopes somewhat towards the sea and has a landing area of 830 × 350 yards. After refuelling I was able to take off with a full load of petrol and made Koepang in six hours, flying mainly over the sea. At Koepang the aerodrome was rather wet, and I found after taxi-ing-in that my wheel spats were clogged with clay mud. In preparation for a take-off across the Timor Sea on the morrow I took the precaution of removing the spats and thoroughly cleaning the wheels. Koepang, which has a civil Customs aerodrome, is an interesting place and a centre of the sandalwood industry. I found that Qantas Airways had sent over a ground engineer for work in connection with the new Singapore extension.

## Over the Timor Sea

EARLY the next morning I filled up all tanks for the long sea crossing, but in trying to take off found that the rain on the previous day had made some new earth on the aerodrome very sticky, and I threw up so much mud that I had to return and make a fresh attempt. By the time I had taxied again to the starting point I found the wheel spats so clogged up that I could not accelerate. There was nothing to do but take them off again, and this time I cleaned them and put them in the cabin.

Finding a stretch which was less muddy, I eventually got off with a full load and was soon over the sea, *en route* for Darwin. Once more I had occasion to bless my low-pressure tail wheel unit, as without it I should certainly not have been able to get off. As I took off the sea was calm, with patches of cumulous clouds from 2,000 to 6,000 feet. I set my course over the Timor Sea at 99 deg. and crossed the coast at 4,000 feet. I flew for nearly two hours on the auxiliary tank, and then changed over to the port tank. Soon after this I ran into a storm area, and I had to alter the course at times to skirt some of the larger storm clouds. After flying for 3 hr. 15 min. I got through the bad weather, but the freshening head-wind made it desirable to fly low. 5 hr. 20 min. after leaving Koepang I sighted some rocky islands, and eventually located a clearance on Bathurst Island, some sixty miles north of Darwin, where I had decided to land.

*Private Flying*

# FROM THE CLUBS

## *Events and Activity at the Clubs and Schools*

### MIDLAND

Visitors to Castle Bromwich included Miss Neison in a "Hawk Major," Mr. Lindsay Everard, M.P., in a "Dragon," and two gentlemen from A.S.T. in "Cadets."

High winds and rain prevented flying on five days and flying times amounted only to 4 hr. 20 min. dual and 3 hr. 40 min. solo.

### HERTS AND ESSEX

The competition for the Alexander Clark Casket has been postponed until Sunday, March 10, when it is hoped that Mr. Clark will personally present the trophy.

Bad weather has interfered with *ab initio* training, but, in spite of this, flying time amounted to 35 hr. 30 min., of which 17½ hr. represents dual. New members include J. G. Baron, D. W. Grant, A. C. Larmuth and J. B. Harrison.

### YORKSHIRE

A new hangar has been erected on the aerodrome alongside the existing building, and a wide stretch of tarmac is being laid in front of the new and old hangars. The new building will house twelve light aeroplanes.

Time flown by club aircraft for last week amounted to 10½ hours. Mr. W. Humble flew to Heston and back.

The final dance of the season will be held at the clubhouse on Saturday, March 23.

### NORTHAMPTONSHIRE

The fine weather last Sunday, after a week of gales, brought quite a number of private owners to Sywell, and many members turned up to fly. It would appear, from the number of people visiting the aerodrome during the week-end, that the neighbouring towns are becoming air-minded.

On March 9 the members will be holding their annual dinner, at which they will be entertaining Mr. Charles Scott and Mr. Ken Waller.

### WITNEY AND OXFORD

Gales have held solo flying in check, and flying time for the past fortnight amounted to 5 hours dual and 7¼ hours solo.

Mr. E. M. H. Slade has resigned from the position of instructor to enable him to take up the appointment of chief instructor to the Bristol and Wessex Aeroplane Club. He commenced his new duties on February 25. A presentation in the form of a silver pint tankard was made to him by the directors, staff and pupils of the club.

### IRISH AERO CLUB

The club's "At Home" at Baldonnel on February 17 was well attended. Capt. J. B. Wilson and Mr. C. Best, of the British Klemm Co., brought an "Eagle" across from Liverpool, where they had been held up by the weather during the morning, and demonstrated it before the crowd, which included the U.S. Chargé d'Affaires (Mr. J. Orr Denby), the Canadian Trade Commissioner (Mr. J. Cormack) and Mr. H. D. McClenaghan, of the Civil Aviation Section, Department of Industry and Commerce. The club's chief instructor, Mr. C. F. Fench, gave an exhibition of aerobatics, and several joy rides were taken, despite a 45 m.p.h. wind.

### HATFIELD

At the first annual dinner of the Royal Air Force Flying Club, held at the R.A.F. Club, Piccadilly, on Friday, February 15, the chairman, F/O. R. E. G. Brittain, said that the club was rapidly expanding, and was in a sound financial position. The minimum number of machines to be available to members for the coming summer was three, of which one would be a cabin machine, and another suitable for aerobatics. Among membership facilities arranged by the committee was that whereby active service members of the R.A.F. and officers of the Auxiliary Air Force, otherwise ineligible, were admitted to membership without entrance fee. F/O. Brittain understood that about eighty members were present at the dinner. He proposed a vote of thanks to Lord Trenchard for the lively interest he took in the club.

Lord Trenchard made a short speech, in which he conveyed the extent and sincerity of his interest in the club. Although much concerned with the fingerprints of its members, he hoped to look after their interests in other ways as well.

Only 24 hr. 20 min. flying time was recorded by the London Aeroplane Club last week, on account of bad weather. New members include Messrs. J. K. Morton, T. C. Pick, and J. G. Milner.

### BROOKLANDS

New members last week included Messrs. Jeffers, Guye, and G. B. Harrison. Mr. Wakefield, a member of the club, has returned to complete his "A" licence tests after a world tour, and Mr. Wheeler is taking an instructor's course.

Visitors included Mr. Tom Campbell Black and Miss Florence Desmond, and Mr. George Lowdell, who flew down from Birmingham, but was unable to return owing to bad weather.

### CAMBRIDGE

Cross-country flying is becoming increasingly popular with members. On Sunday last eleven members of the Civil Aviation Corps flew, but there were no new soloists. Flying times for the week ended February 22 were: dual, 20hr. 15 min., and solo 4hr. 30 min., the decrease being due to gales. Three new members joined during the week, Mrs. Montgomery and Messrs. Jones and Kyle.

### HANWORTH

Flying for the week amounted to 34 hr. 40 min. Two non-flying days were recorded. First solos were made by Commdr. J. C. Clouston, R.N., Messrs. T. Smythe and J. Gudgeon, and "A" licence tests were passed by Commdr. Clouston, after having made his first flight exactly ten days before. The Marquess Hachisuka renewed his "A" licence. There are two new members, Mr. Baner, of Sweden, who is taking his "B" licence, and Mr. Sorapure.

### CINQUE PORTS

Mr. Georges Seversky, a member of the Cinque Ports Flying Club, and famous as a cabaret artist, will entertain members at the club dinner and dance to be held on March 15. He is bringing with him two fellow artists, Miss Hildegarde and Mr. Dima Oussoff. Mr. Barr has purchased a Salmson-engined Klemm from the club, in order to learn to fly and obtain his "A" licence, and Mr. C. A. Macdonald has joined the club and also intends to learn to fly. Total flying time, both dual and solo, amounted to 19 hours.

### LANCASHIRE

The Lancashire Aero Club has been approved by the Air Ministry for instruction in blind flying and for the issue of the necessary "B" licence certificate.

Flying hours during the past month are up by 50 per cent. on the figures for the corresponding month last year, an "A" licence has been gained by Mr. Warburton, a first solo has been made by Mr. Hooson on the Autogiro, and five new members have joined.

The next Pemberton and Rodman landing competition will be held on March 23, after which there will be a hot pot supper in the best old style.

### NORFOLK AND NORWICH

There was a goodly gathering of members for the supper dance held at the club last Friday. Another dance will follow the annual dinner which is being held at the club on Friday, March 29.

The public meeting which is being organised by the club at the Stuart Hall on Wednesday, March 6, is being well supported. The subject of the meeting will be "Municipal Airport Development," and the chief speaker is Mr. John Dower, M.A., A.R.I.B.A., who is a member of the Aerodromes Advisory Board. Leading representatives of the city and county will be on the platform.

### READING

Members of the Reading Aero Club were presented with a beautifully furnished navigation room when, on February 17, Lord Apsley introduced Mr. and Mrs. George Royle, the donors. The gift, it will be remembered, has been made in memory of their son Gerald Royle, an extremely keen young pilot, who met with a fatal accident at Scarborough last summer, and who often flew at Reading Aero Club.

Apart from this room, Mr. and Mrs. Royle have given £200 to start a fund to enable the members to purchase their own aeroplane, so that members will be able to fly at a cheap rate.

Among those who have been flying regularly at Reading of late is Mr. G. H. Woodhouse, aged 17, who originally went solo two years ago, but who has been prevented from flying during the last six months because he is "under age."

The Phillips and Powis School has been very busy, and two "Moths" and three "Hawks" are in regular service. The date of the club's annual garden party has been provisionally fixed for Saturday, June 22, at 3.30 p.m.

# COMMERCIAL AVIATION
## —AIRLINES —— AIRPORTS—

## AIR TRAVEL IN ALASKA

*How the Aeroplane Has Succeeded the Dog Sleigh : Alaska as a Stepping-stone to Asia*

THE creation of regular commercial air routes in Alaska had two purposes —first, to supply efficient communications in a land where the existing means of transport were very primitive, and, secondly, to provide a stepping-stone for a future air route to Asia.

In Alaska aviation has no competitors. In more than half a million square miles of territory there are only 914 miles of railway, 1,589 miles of wagon roads, 1,404 miles of sleigh roads and 7,860 miles of trails. There is only one important railway in the whole country, namely, the Alaska Railroad, which runs the 467 miles from Seward to Fairbanks. For the rest, Alaska has had to depend on the long and winding rivers, and especially upon the River Yukon.

During the short summer no great difficulties were encountered, for Government-owned steamships plied their way up and down the rivers with mails, passengers and cargo. But during the long sub-Arctic winter there were only the dog-teams drawing their slow sleighs over the surface of the same rivers, now frozen solid. The real crises in Alaskan communications occurred in spring and autumn, when the rivers were thawing or freezing—when the ice was too thin to bear the sleighs and yet too thick to permit the passage of steamers. For several weeks at a time the rivers were closed to both forms of transport.


**Air, rail and river routes in Alaska.**

### *The Pan American Entry*

The economic possibilities of aviation in Alaska were realised when in the summer of 1929 the Alaskan Mapping Expedition surveyed 13,000 square miles of South-East Alaska, photographing from a height of 10,900 feet. In the early years of experimentation many uneconomic air routes were opened, and rival companies worked against each other without any attempt at co-ordination. But in the summer of 1932 Pacific Alaska Airways Inc., the operating subsidiary of the Pan American Airways System, took over the Alaskan Airways and the Pacific International Airways, together with a varied collection of machines and equipment.

Much of the old material has since been scrapped, and last year the little fleet of Pacific Alaska Airways consisted in all of five aeroplanes—which is quite big for a country with no more than some sixty-thousand inhabitants, of whom less than half are Whites and the remainder Indians and Eskimos. This fleet consisted of three Fairchild machines with "Wasp" engines, one Fleetster, and one single-engined Ford, both with Wright "Cyclone" engines and controllable pitch propellers. The personnel numbered twenty-eight, including six pilots, six mechanics, two wireless operators, and three guides chosen for their special knowledge of the topography and climatic conditions of the country.

The chief air port and base of Alaska is at Fairbanks, a small town with about 1,200 inhabitants, to which supplies are brought from Seward by rail. The air port has only one hangar. This is made of corrugated metal with an inner lining of wood. Between the wood and the metal exterior there is a layer of sawdust with a thickness of about ten inches to provide insulation against the extreme cold of the winter. The hangar is used when repairs are needed. Owing to lack of accommodation and to avoid damage to the structure of the machines through violent changes of temperature, the aeroplanes when not in use are normally left in the open, where they are raised on blocks of wood to prevent them freezing to the snow.

At Fairbanks there is a central weather bureau which issues reports twice a day. These reports are based upon information supplied by twenty-two outposts of the U.S. Army Signal Corps stationed in different parts of the country.

In the long and severe winters great demands are made upon the services of the Airways. The aeroplanes are then fitted with skis, and each machine carries an emergency outfit comprising food, snowshoes, rations, rifles and ammunition, and canvas covers to protect the engines. Preference is given to the mails, any space left being available for passengers and freight. In December there are only about three hours of daylight, and the aeroplanes frequently leave before dawn to avoid reaching their destinations after nightfall.

### *Some Comparisons*

What aviation means to Alaska is best shown by the fact that an aeroplane travels in one hour approximately the same distance which a dog sleigh covers in a week. From the port of Nome on the Bering Strait to Fairbanks is a journey of from five to six hours by air, while the dog teams running their twenty miles a day take from four to six weeks to cover the same distance. Moreover, the cost to the passenger is only half as much by air as by dog sleigh. Small wonder is it, therefore, that as early as 1930 it was estimated that of passengers making journeys of 200 miles or more, ninety per cent. chose the air route.

During the winter months, from September to June, the Pacific Alaska Airways averages some fifty flying hours a week. In the slack summer season, when the mails are

## Commercial Aviation

taken by steamships, the number of flying hours is reduced by half. The short summer, with its twenty-odd hours of light a day, is a period of ease and comfort in Alaska. Then the skis are removed from the aeroplanes and replaced by floats, for there are numerous rivers and lakes. In the late spring the bitter Arctic winds cease and warm breezes blow from the Pacific Ocean. Alaska even has heat waves, temperatures of 90 deg. Fahrenheit in the shade being occasionally recorded. The swamps and pools caused by the thaw then become infested with flies and mosquitoes.

In the more developed countries travelling by air is still in the nature of a luxury. But in Alaska miners, trappers, fur dealers and salesmen utilise the services of Pacific Alaska Airways, as well as Government officials, tourists and big game hunters. Apart from the regular routes aeroplanes can be chartered for special purposes. In summer they are often used for exploring the interior of the country. Among the many services rendered by the Airways it is worth mentioning that sick and injured persons are often taken by aeroplane to the hospital at Fairbanks.

The less economic air routes have recently been discontinued. The programme for the last winter season provided only for the lines Fairbanks-Nome, Fairbanks-Bethel, and Fairbanks-Livengood. These routes, with the Alaska Railroad, are sufficient to link up the less sparsely populated areas. The time-tables are subject to frequent alterations, but the routes mentioned are served once or twice weekly. Pacific Alaska Airways have recently, as reported in *Flight*, taken delivery of its first Lockheed "Electra" and an extension has been planned from Fairbanks to Whitehorse and Juneau in Canada.

These are the main features of aviation in Alaska from the purely Alaskan point of view. The larger aspect, too, is interesting. The Pacific Ocean, unlike the Atlantic, can easily be spanned without the aid of Seadromes, for the route would be over or near to land all the way. With a refuelling depôt on the Alaskan mainland and perhaps another on one of the Western Islands of the Aleutian group, a service to Japan and China by seaplane would present no great difficulties. The acquisition in 1933 by the Pan American Airways system, of a 45 per cent. interest in the Chinese National Aviation Corporation has brought this prospect appreciably nearer. With the great commercial interests which the United States holds in the Far East it is improbable that she will be content to see the main air routes in that part of the world developed by foreign nations.

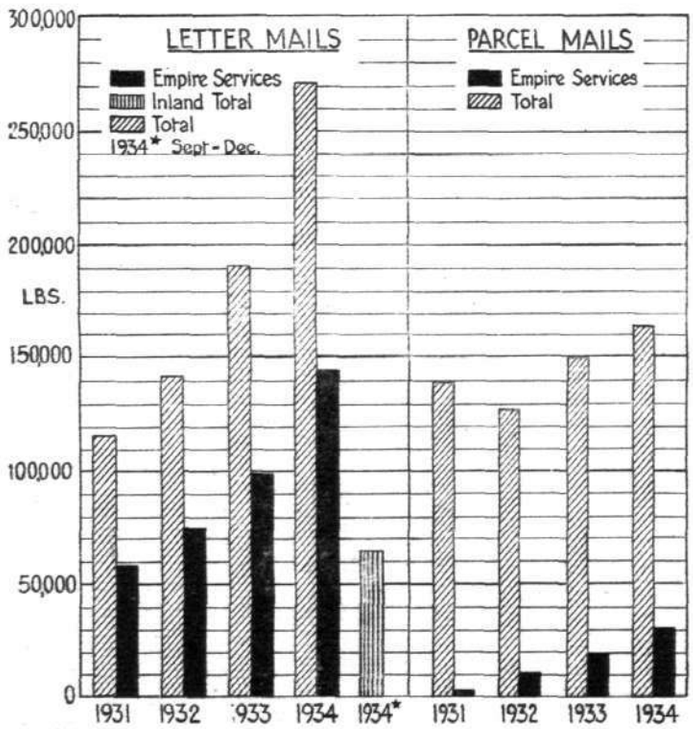
Alaska has been called the "Arctic Laboratory" of the United States. Much has been learnt there of the reactions of aircraft to abnormally low temperatures, the kind of fuel required, and the care and heating of engines. The strategic value of the territory to the United States from the military viewpoint is also an important factor in the future of Alaskan aviation. But this is beyond the scope of the present article. G. A. HIXKSON.

### *Mail to the Congo*

A weekly air service is now available for air correspondence for French Equatorial Africa and the Belgian Congo, *via* France. The first despatch from London will be made on Friday, February 22, and thereafter despatches will be made every Thursday.

### *The Last Throw*

By a firm majority Manchester's Council rejected a resolution urging the abandonment of the new Ringway airport scheme. Presumably, now that Air Ministry sanction has been obtained, the work will be put in hand. No more tram rides for Manchester pilots! Meanwhile, however, there are strong rumours that the whole business may reach the High Court.




**AIR MAIL DEVELOPMENT: These diagrammatical statistics show the useful rise in the weight of air mail since 1930 and, particularly, the high proportion of internal mail, notwithstanding the fact that it was carried only for a short period.**

### *Air France Changes*

After March 1 the Air France machine to Paris will leave Croydon at 10 a.m. instead of 9 a.m., the afternoon service will leave Croydon and Le Bourget at 3.30 p.m., and the Vienna-Budapest-Belgrade-Bucharest service will be run every week-day.

### *Air Mail in New Zealand*

Air Travel (New Zealand), Ltd., mentioned in last week's *Flight*, has started operations, carrying passengers as well as letters and parcels at ordinary rates, using a D.H. "Fox Moth." The company will operate three times weekly between Canterbury and Westland, and fortnightly between Hokitika and Haast on the west coast.

### *Blackpool Development*

The municipal aerodrome of Stanley Park, at Blackpool, has been leased to a subsidiary company of the Whitehall Securities Corporation. This new company will operate the aerodrome, which will be open to all comers at the usual landing charges, and will concentrate both on the development of air lines in the north and on satisfying such demand as there is in the district for joy-riding.

One of the first lines to be started will be from Blackpool to the Isle of Man, and, at the request of the Corporation of Blackpool, a service will be run between Blackpool and London. It is understood that operations will start in the early spring, the aeroplanes used being D.H. 89's, Spartan "Cruisers," and D.H. "Dragons."

### *Canadian Airways During 1934*

The most outstanding figure in the statistics covering Canadian Airways' operations in 1934 is the weight of goods carried. From a total of 764,449 lb. (382 tons), in 1931, the figure has risen to 5,766,691 lb. (2,883 tons). Only a decade ago the total for air mail and express carried by *all* aircraft in Canada amounted to 39 tons for a year. Nearly 80 per cent. of this load was carried into that hitherto undeveloped territory which lies north and west of the Great Lakes—Western Ontario, Manitoba, and the North-West Territories. Machine units of 1,000 to 1,200 lb. are accepted as a matter of course.

Air mail services in Canada are limited entirely to the mining areas and to remote points which lack speedy ground transport. Since the discontinuance of the Prairie Air Mail service in 1931 these auxiliary services have shown a steady increase. Last year 472,308 lb. of mail and 16,594 passengers were carried. The pound-mile figures for express and mail amounted to 507,167,910 and 84,766,350 respectively.

Since January 1, 1927, Canadian Airways pilots have flown a total of 10,750,215 miles.

# CROYDON

## *New Probationary Officers : Left Luggage : Queer Cargo—by Air France : Those Alterations : The Airport Staff Dinner*

AT the beginning of last week ten new probationary first officers joined Imperial Airways, Ltd. They are to stay for a month or so at Croydon attending lectures, attached to various departments, or working on shifts in the hangars, and will then fly on the routes as what may be called second officers. Some of them are from the R.A.F. and a few from Hillman's Airways.

The Railway Air Service machine from Liverpool is due at Croydon at 12.20 p.m., thus connecting with Imperial Silver Wing 12.30 p.m. for Paris. No connection is guaranteed, but passengers occasionally make the Liverpool-London-Paris flight by this means. As a rule it is a matter of minutes, and everything has to be done at the double. The other day I was almost run over by a party consisting of a small, fat man, passport in hand, urged on by athletic officials, cantering wildly down the corridors. He had flown down from Liverpool, and the Silver Wing, snorting indignantly, was awaiting him. He went through the cabin door looking rather like a hunted rabbit.

M. Pritz, a Swedish Government official, over here to meet the Brazilian Trade Delegation, came through last week by Scandinavian Air Express. He left Gothenburg at 1.30 a.m. by train and arrived at Croydon at about 3.0 p.m., having caught the aeroplane at Malmö.

Olley Air Service, Ltd., had the job, last Friday, of flying a man's luggage from London to Liverpool to catch the *Duchess of Athol*. It was done with no more than a few minutes to spare. A forgetful passenger this, evidently, for the luggage consisted of such items as hat boxes, travelling rugs, and brief cases, as well as trunks and suit cases.

Capt. Lock and First Officer Thomas, of Imperial Airways, left Croydon, Australia bound, with the last of the "Diana" class machines on Friday.

Amongst queer air cargo, Air France now carries quite a large quantity of edible snails from Paris for the French restaurants in London. Queerer still is the import by the same company of empty shells of the edible snail. Presumably there is such a thing as "mock escargot," and if you come across synthetic snails in Soho you will know where the shells come from!

Alterations to enable passports to be examined before baggage is cleared are actually in progress and are going forward with a speed easier to be imagined than described. My guess about the height of the busy season coinciding with the peak period of this reconstruction job appears as if it might be an accurate one. The necessity for this change becomes increasingly apparent. Large machines carrying a majority of business travellers mean more samples being carried, and "merchandise in baggage" means that the passenger is necessarily delayed in the Customs Hall.

Next summer, for example, the K.L.M. F36 is due in here at 10.55 p.m., and will have business travellers on board from a very large number of European cities. Fifteen out of thirty may have merchandise in baggage, and under the present system passport officials must hang about waiting for them to clear Customs. I notice, by the way, that it is taking longer than it did formerly to examine passports of outgoing passengers. Presumably this cannot be helped, but it is regrettable and leads to late departures.

The annual Airport of London Staff Dinner and Gala Ball was held at the Greyhound, Croydon, last Friday. About 350 people were present. Maj. L. F. Richard, Chief Aerodrome Officer, was in the chair, and Capt. T. Atkings acted, very ably, as toastmaster. Unfortunately, the microphones let the party down, and several excellent speeches were relayed to an astonished audience as a mere succession of dreadful booming and braying noises. The only person I heard clearly was Mrs. Bouderie, wife of the Air France manager, who replied on behalf of the ladies in a delightful little speech. Microphones, for after-dinner speeches, are signs of a degenerate age, anyway, and people should be able to make themselves heard without them. The band was very good and deserves an extra word of praise, because it is run by Mr. W. Hutchinson, an Airport Customs official, and several of the players are also employed at the aerodrome. Capt. Anderson, now chief pilot, Hillman's Airways, and formerly well known at Croydon, was a welcome guest. He responded on behalf of the visitors.

Everybody appeared to enjoy this, the third annual Airport dinner.

A. VIATOR.

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### *Air Mail Alterations*

On and after March 1 there will be a number of changes in the latest times of posting of air letters for European countries, North Africa, the U.S.S.R. (Asia), and Indo-China. A correction notice will be sent out in due course.

### *The Hull—Plymouth Service*

The new service between Southampton and Hull, linking with that from Plymouth, will be inaugurated next Monday. On this occasion a machine or machines will fly through from Hull, which will be left at 8.30 a.m., to Plymouth, returning at 1.40 p.m., and either Lord Londonderry, Secretary of State for Air, or Sir Samuel Hoare will perform the opening ceremony at Hedon, Hull.

At present Hedon has no radio equipment, but this will be remedied in due course and in time for the K.L.M. service. Plymouth, too, is to be equipped during the year.

### *New Machines for Deruluft*

Important changes will be made this year in the Deruluft line between Leningrad, Tallinn, Riga, Konigsberg and Berlin. The machines will stop at Kaunas, the capital of Lithuania, after Riga, and the Rohrbach "Rolands" flying from the German side will be replaced by new U-52 16-seaters, and from the Soviet side the line will be served by ANT-9 machines. The new fleet will shorten the journey to Berlin by an hour.

### *New Frequencies for Croydon*

In order to reduce the congestion on 900 m. and 862 m. separate channels, available for both R/T and W/T, have been provided for Q.B.I. conditions within forty miles of Croydon. These are 325 kc/s (923 m.) for air to ground communication and 322 kc/s (932 m.) for ground to air communication. Bearings can be given on these frequencies, which will be used experimentally from March 4 and continuously from March 17, and instructions for the change-over must be given by Croydon to the pilot as he enters the zone.

### *Across India*

On Monday Mr. Neville Vintcent flew the first transcontinental mail direct from Bombay to Calcutta in twelve hours. This day and night flight with a "Fox Moth" was made by Tatas to demonstrate the possibilities of such a service. It was originally intended that an Airspeed "Envoy," carrying the D.C.A., should be used.

### *Changes at Hillman's*

Last week it was announced that Capt. T. Neville Stack had been appointed air superintendent and manager of Hillman's Airways, and that Mr. Edward Hillman had left the board.

Capt. Stack's duties, which he started on Friday, do not interfere with those of Capt. Anderson, who, as chief pilot, had previously been in charge of general flying operations.

Mr. J. Kirton, who was unlucky enough to be the pilot both in the recent tragedy and in the case of the lost gold, is leaving the company shortly. He actually resigned more than a month ago in order to take another appointment, and his departure, of course, is not connected in any way with the two unfortunate accidents. The loss to the company will be considerable, for Mr. Kirton has had a long experience both as an instructor and commercial pilot, and holds, among other qualifications, a first-class navigator's certificate. Only eight of these have been issued.

It is probable that Hillman's Airways will eventually obtain Air Ministry sanction to use the Marconi direction finding equipment which has been installed at Essex Airport. The pilots will continue to use the Croydon control, of course, but the D/F equipment will be invaluable for guiding machines in over the last ten miles or so from the Thames in conditions of bad visibility. Transmission will probably be restricted to a ten-mile range. At the present moment a receiving set is in use at Stapleford Abbotts, enabling the control there to listen to any messages given to or by the Hillman machines travelling either to Paris or the North of England.

# Correspondence

*The Editor does not hold himself responsible for opinions expressed by Correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters intended for insertion in these columns.*

## ICE FORMATION

[3011.] In your interesting article in *Flight* of February 21, on the formation of ice on aircraft, it is stated "why it is that super-cooled droplets remain in liquid form has never been satisfactorily explained, but since it actually occurs the fact must be accepted."

I should like to suggest that the reason for the difficulty experienced in freezing water in the form of a mist, compared with that of water in bulk, is because the droplets of water in the mist are subjected to a pressure far greater than that of the atmosphere in which they are floating. This pressure is due to the surface tension, and it is not difficult to compute the lowering of freezing point which must result.

I will not tire you with the details, but the result is to show that the additional pressure due to surface tension in a drop of water $10^{-5}$ cm. in diameter will lower the freezing point by 2.2° C. The lowering of the freezing point is inversely proportional to the diameter, so that a water droplet of $10^{-7}$ cm. diameter would freeze at −22.2° C., whereas the freezing point of water in bulk is, of course, 0° C. N. A. DE BRUYNE.

Cambridge.

## HARNESSING THE PASSENGER

[3012] There appeared recently in *Flight* a letter [3010] lauding the American habit of fastening passengers to their seats in bumpy weather before taking off and before landing.

Why this curious custom survives over there is interesting. In Europe it seems to be as dead as that other primitive habit of fixing each passenger personally into an inflatable lifebelt before crossing the Channel by air.

Flown at the right height and properly handled, the big aeroplane of to-day suffers so little from bumps that not one of the European companies finds it necessary to use safety belts for passengers. Landing and taking off are as much without incident on the air routes as the departure or arrival of express trains, and it is incomprehensible that any necessity can exist for placing passengers in strait waistcoats at these times.

Imperial Airways, Ltd., do not even fit safety belts to the big machines, and K.L.M. have them tucked away out of sight, in case of some such rare emergency as a burst tyre and consequent rough landing. Experience has shown that these gadgets are primitive and unnecessary with big aeroplanes. Why, then, must we copy the Americans in this matter and put our passengers to an inconvenience bound to give them an impression of possible danger which actually does not exist?

Incidentally, there is a vast difference between travel in a machine such as *Heracles* and some of the smaller aeroplanes on internal lines, where high flying to avoid bumps may not be practised. In such flying, safety belts would be a boon in rough weather, because, instead of having to hang on to his chair with both hands, the passenger could use them to hold his book or newspaper. Possibly the writer of the letter to *Flight* had no experience of "air liner" travel as distinct from "air taxi" travel. A. VIATOR.

London.

[Although we agree in principle with "A. Viator's" statement that safety belts should be unnecessary and that they may produce the we-are-about-to-have-an-accident complex, they are at least a great comfort in smaller passenger machines. Has "A. Viator" never split his skull on a luggage rack on a really bad day? At reasonable heights the bumps are few, but devastating when they do occur—over the coast, for instance—and an aeroplane, in any case, must be flown through the bumpy part of the atmosphere either before or after a stratospheric journey. Incidentally, D.L.H. still consider that safety belts are useful.—ED.]

## PETTY C. OF A. REGULATIONS

[3013] During the past few years I have heard of a hundred and one good reasons why ownership figures remain comparatively low. May I stress one of these once again at a time of the year when a number of prospective owners are reconsidering the question?

Two years ago a friend of mine who is, at the same time, a very capable automobile engineer, altered, for his own comfort and using the best of materials, various purely auxiliary control details. When the time arrived for the C. of A. renewal he was forced to replace all the improved fittings of his very obsolescent machine with "approved" parts designed some years before. He sold the machine and ceased to take more than an academic interest in aviation.

With very little further discouragement, another owner friend of mine will be throwing the whole thing up in disgust. During this year's C. of A. the inspector stated that a metal strut, which required a fairly simple reconditioning repair, *must* be returned to the makers.

Now the firm in question is much too busy on the production of commercial machines to be bothered with a small machining job, and probably it has been sub-contracted. Here, again, the firm may be busy on repetition work, and will not feel like setting a mechanic and a few machine tools aside for a small job, and there the offending part remains. In one case I know this particular part was held up for thirty-two days!

Meanwhile my private owner's machine is out of action. Not a very serious matter to him, but terribly serious for a school or club in the same circumstances.

Is it wholly necessary that *all* these parts should go back to the original makers—who have long lost all interest in them—just because there is some petty regulation in force? I cannot see why a firm carrying out the C. of A. should not also be allowed to do the reconditioning work and have it passed by the A.I.D. or Lloyd's inspector. AIR WORTHY.

London, S.W.3.

## HORSE-POWER RATINGS

[3014] As it seems that we may be treated to an Aero Show on the lines of the Motor Show, judging by what has been read in your columns recently, may I suggest that, as civil aircraft will receive greater publicity than they have ever received before, engines cease to be known in terms of b.h.p., and terms of nominal h.p. used instead?

I make this suggestion since it is my firm conviction that the public are completely led astray as to running costs. How many of them realise that a Gipsy Major has a capacity of under eight litres? D. A. VARLEY.

Wokingham, Surrey.

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## NEW COMPANIES

SANDOWN AND SHANKLIN FLYING SERVICES LTD. Capital £500 in £1 shares. Objects: To adopt an agreement with Ernest H. Byrne for the purchase of the business of Shanklin Flying Services, carried on by him at Shanklin, I. o W.; together with two aeroplanes and spare parts and accessories, equipment and hangars; and the right to take a lease of Lea Farm Aerodrome for 21 years. The first directors are:—Ernest H. Byrne (permanent managing director), "Ankerdine," Clarence Gardens, Shanklin, I. o W.; Wm. A. Andrews, 59, Newport Road, Lake, I. o W.; Mrs. Violet A. E. Byrne, "Ankerdine," Clarence Gardens, Shanklin, I. o W.

BOURNEMOUTH AIRPORT LIMITED. Nominal capital of £26,250 in 25,000 ordinary shares of 1/- each and 25,000 6% preference shares of £1 each. The objects are to adopt an agreement with F. C. Fisher and H. Clive Smith, to acquire any lands and other properties; to lay out, adopt and develop any lands as aerodromes, air-ports, athletic or sports grounds, racing tracks, pleasure grounds and gardens, and recreation grounds; to carry on the business of aerial transporters of passengers, merchandise, produce, mails and goods, organisers and maintainers of air services, engineers, owners, licensees and hirers of air and road transport in Great Britain and elsewhere, aeronautical engineers, instructors in aeronautics, manufacturers of and dealers in aeroplanes and aircraft of every kind, etc. The subscribers (each with one ordinary share), are:—Francis C. Fisher, 150, Imperial House, Regent Street, W.1, air pilot; Havelock Clive-Smith, 150, Imperial House, Regent Street, W.1., engineer. Solicitors: Birkbeck, Julius, Edwards & Co., 49, Moorgate, E.C.2.

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## CHANGE OF NAME

AVIATION DISPLAYS LTD. (Salisbury Square House, Fleet Street, E.C.4). Name changed to Jubilee Air Displays, Ltd., by Board of Trade Letter dated February 5, 1935.

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## AERONAUTICAL PATENT SPECIFICATIONS

*Abbreviations:* Cyl. = cylinder; i.c. = internal combustion; m = motors. (The numbers in parentheses are those under which the specification will be printed and abridged, etc.)

### APPLIED FOR IN 1933

*Published February* 28, 1935.

18435. IRVIN, L. L. Harnesses or the like for parachutists. (423,501.)
23355. ELETTNER, A. Aircraft. (423,371.)

### APPLIED FOR IN 1934

21265. BOULTON & PAUL, Ltd. Aeroplanes. (423,565.)

# FLIGHT

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# MISCELLANEOUS ADVERTISEMENTS



## Aircraft and Engines For Sale

MILES MARTLET, Genet II. C. of A. till end of June. Ideal aeroplane for young man wanting to put in hours cheaply and safely. A. R. Ramsay, Reading Aero Club.

FOR SALE.—A.N.E.C.II Light Monoplane. 40 h.p. A.B.C. Scorpion. Engine 30 hours. Airframe as new. Entirely reconstructed and smartly repainted. C.A., November. Very economical and fascinating to fly. 2 galls. per hour. Speed range 70/25 m.p.h. Full instruments. Ideal obtain "B" hours. Safe in any hands and extremely attractive. Photographs. Price and particulars, write Box No. 4678, c/o "Flight," Dorset House, Stamford Street, London, S.E.1.

CIRRUS III KLEMM.—12 months C. of A. New engine, only done approximately 10 hrs. Fitted extra inclinometer in F/Cockpit. Colour—black with silver registration ... ... £260
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GIPSY I MOTH.—C. of A. July, 1935. Total hours 680, since C. of A. 20 hrs. Engine hours since top overhaul 59 hrs. Fitted with slots ... £350
GIPSY I MOTH.—Fitted with slots. C. of A. Dec., 1935. Hours flown since C. of A. approx. 25. Engine completely overhauled at C. of A.... £360
GIPSY I MOTH.—C. of A. August. Engine—27 hrs. since complete. Fitted blind flying instruments, extra compass, slots ... ... ... £375
Phillips & Powis Aircraft (Reading), Ltd., Reading Aerodrome, Berks.

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A. P. THURSTON & CO., Chartered Patent Agents, 329, High Holborn, W.C.1. Tel.: Hol. 1117.

F. J. CLEVELAND & CO., Chartered Patent Agents, 29, Southampton Buildings, London, W.C.2. Telephone: Holborn 5875-6.

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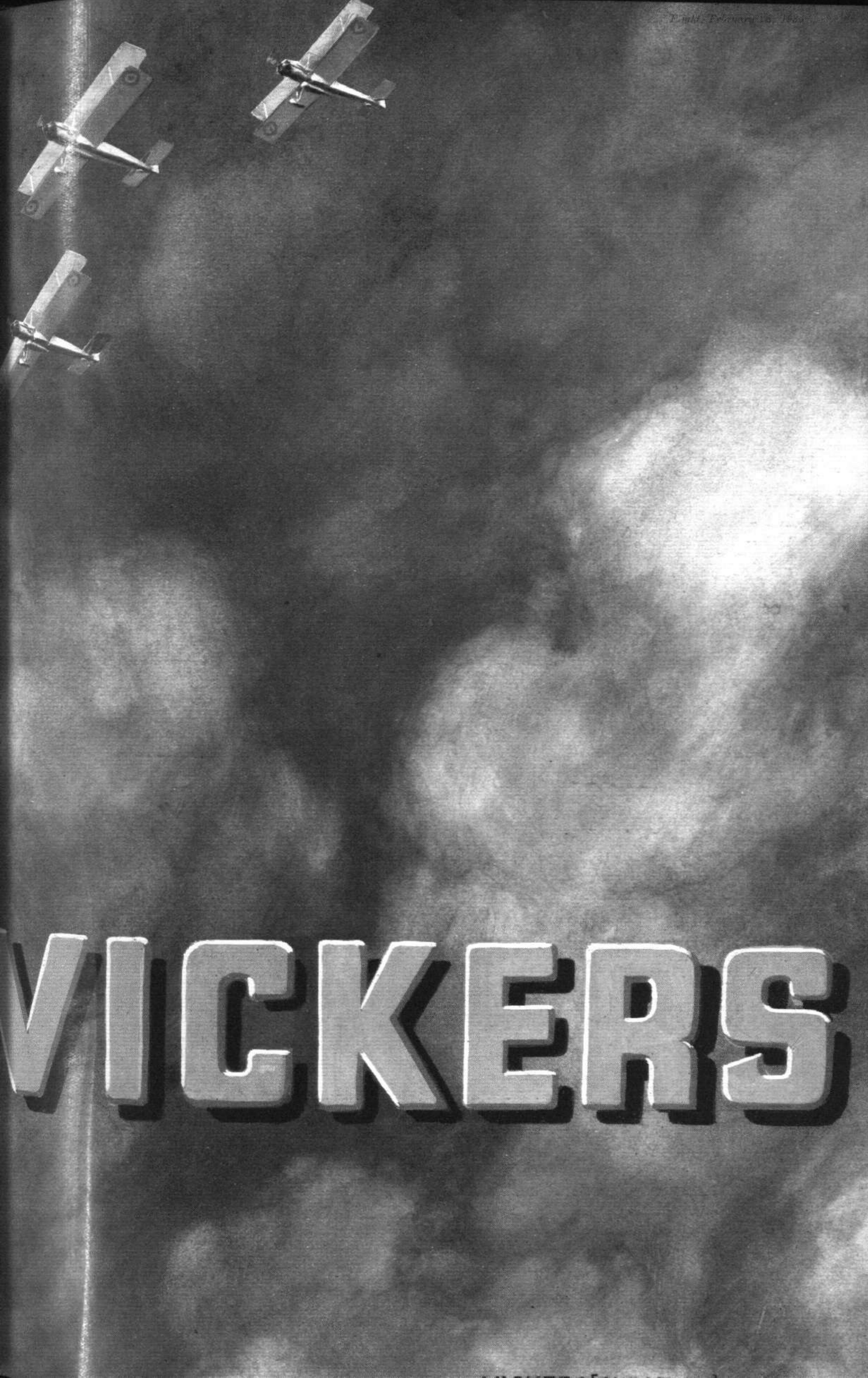
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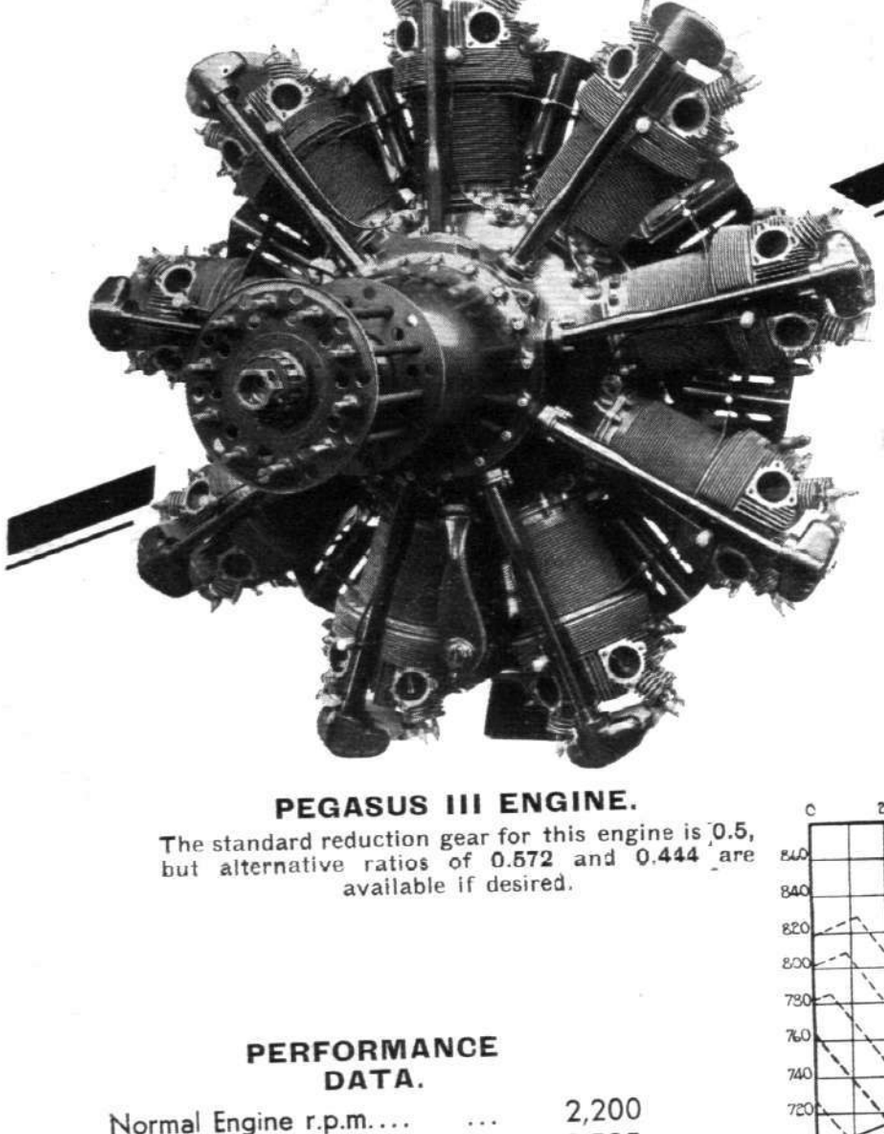

"Bristol"

# PEGASUS III
## AIRCOOLED ENGINE

is designed to operate on the service fuel of 87 minimum octane value and has an exceptionally attractive power output for take-off and climb. Although the supercharger is of the medium speed type and maintains normal pressure in the induction system up to 4,750 ft. at maximum r.p.m., full throttle power is available for take-off and climb. In view of these characteristics, this engine is suitable for a wide range of aircraft covering general service types, marine aircraft and certain civil machines where a good performance at altitude is necessary.

### PEGASUS III ENGINE.

The standard reduction gear for this engine is 0.5, but alternative ratios of 0.572 and 0.444 are available if desired.

### PERFORMANCE DATA.

| | |
|---|---|
| Normal Engine r.p.m.... ... | 2,200 |
| Maximum Engine r.p.m. ... | 2,525 |
| B.H.P. for take-off at Sea Level at normal r.p.m. ... ... | 750/775 |
| Rated Output at normal r.p.m. | 665/690 at 3,500 feet |
| B.H.P. at maximum r.p.m. | ...725/750 at 4,750 feet |
| Fuel Specification ... | ... D.T.D.230 |
| Minimum octane value ... | 87 |

*Designed and Manufactured by*
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**POWER AT ALTITUDE.**

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